

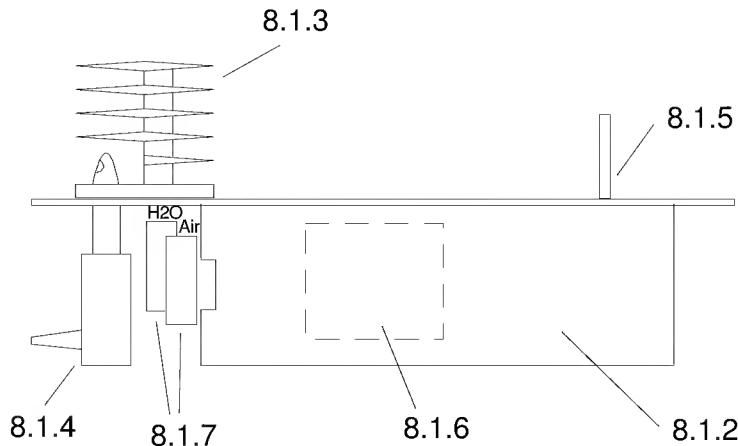
## 8. Repair Information Unit, Electronics Module, Climatic Sensor

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## 8.1 Unit

### 8.1.0 Table of Contents



- 8.1.1 Information on Units Used
- 8.1.2 PCB Unit and Fuses
- 8.1.3 Air Heating with Thermal Release
- 8.1.4 Boiler with Water Heating and Thermostatic Switch
- 8.1.5 Fan Motor
- 8.1.6 Mains Transformer
- 8.1.7 Semiconductor Relay
- 8.1.8 Testing of Unit (Complete)
- 8.1.9 Voltage Selection
- 8.1.10 Replacement of Unit in the event of Repair
- 8.1.11 Repair Information and Change Status

## 8.1.1 Information on Unit 2M 20 276 / 2M 20 615 (of Inc. 8000 SC/IC/NC)

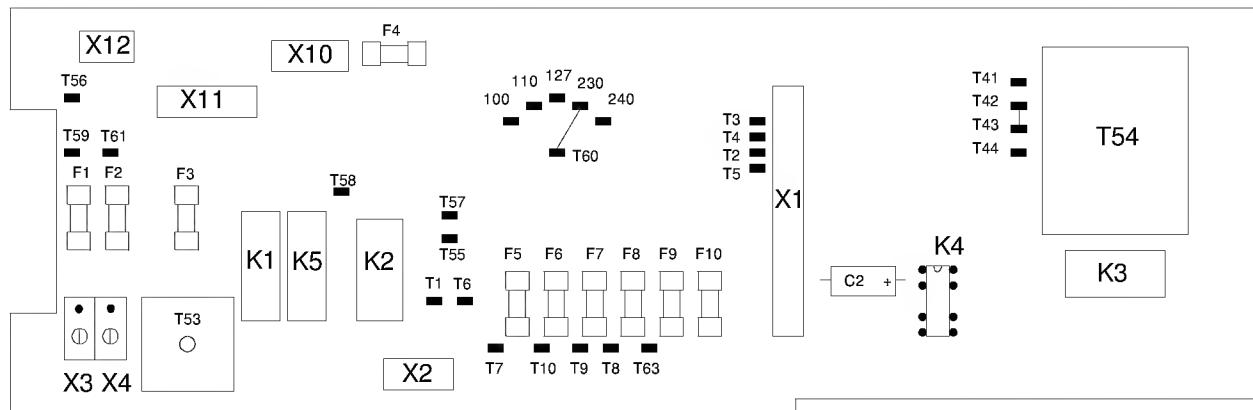
Characteristics:

- PCB Unit 82 90 511
- All connections to printed circuit board plugged-in
- Heating cartridges for one mains voltage only (100 V, 120 V / 127 V or 230 V / 240 V)
- Boiler (complete) plugged-in. In the Inc. 8000 SC/IC/NC it can be removed through a service opening without dismounting the Unit

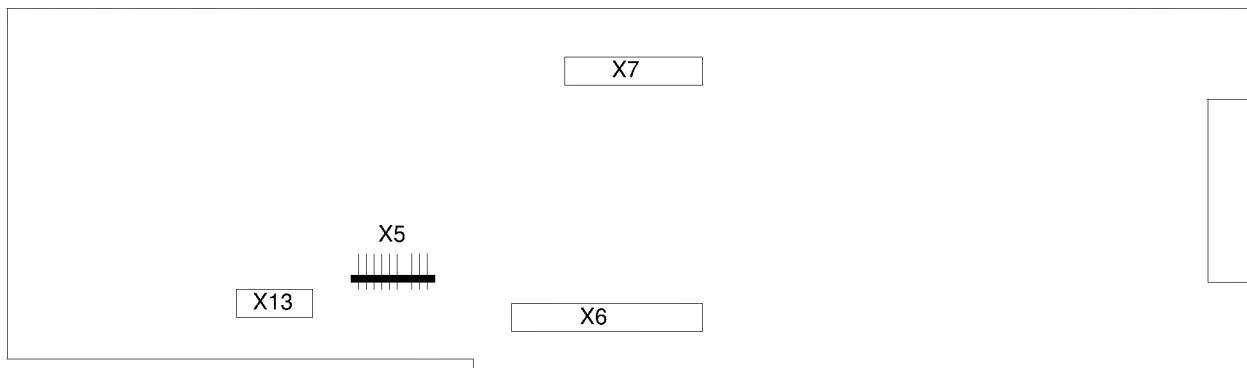
Since both Units are identical as far as their function is concerned it is possible to use the Unit 2M 20 615 in the Inc. 8000, refer to 8.1.9 "Replacing in the event of Repair".

## 8.1.2 PCB Unit and Fuses

Layout Component Mounting Side:



Layout Rear:



Component Mounting without Fuses:

Position	Component	Function
X1	Connector 18 13 641	Cable connection to electronics module
X2	Connector 18 13 544	Cable connection to valve(s)
X3, X4	Terminal 68 04 759	Mains connection
X5	Connector 18 10 669	Connection for coil of fan watchdog, Thermostatic switch water shortage and control of semiconductor relay
X6	Connector 18 28 592	Connection mains voltage for transformer
X7	Connector 18 28 576	Return transformer voltages
X10	Connector 18 28 533	Connection heating cartridge for water heating
X11	Connector 18 28 541	Connection semiconductor relay supply side
X12	Connector 18 28 525	Connection heating cartridge of air heating
X13	Connector 18 28 533	Connection fan motor
K1, K5	Relay 18 30 732	Mains closing relay
K2	Relay 18 21 474	Safety relay for heating
K3	Relay 18 21 474	Safety relay for valve(s)
K4	Relay 83 01 198	Safety relay for disconnection Semiconductor relay of heating valve(s)
T54	Transformer 18 13 927	Auxiliary transformer for mains closing relays K1 and K5

Fuses:

<b>Position</b>	<b>100 V to 127 V</b>		<b>220 V to 240 V</b>	
F1, F2	T 6,3 A	18 15 172	T 3,15 A	18 15 148
F 3	T 80 mA	18 14 974	T 40 mA	18 14 931
F4	T 1A	18 15 083	T 500 mA	18 15 059
F5	T 200 mA	18 15 016	T 200 mA	18 15 016
F6	T 500 mA	18 15 059	T 500 mA	18 15 059
F7	T 2,5 A	18 15 121	T 2,5 A	18 15 121
F8	T 1,6 A	18 15 105	T 1,6 A	18 15 105
F9, F10	T 160 mA	18 15 008	T 160 mA	18 15 008

**Testing:**

Refer to 8.1.8 "Testing Unit (complete)"

**Replacement in the event of repair:**

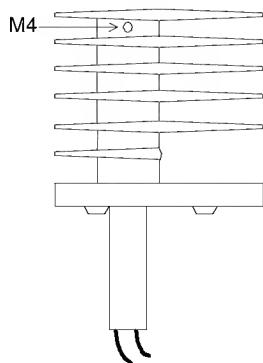
In the event of repair the PCB Unit 82 90 511 (complete) can be replaced or components can be renewed. All relays are available for this purpose, refer to component mounting list.

### 8.1.3 Air Heating with Thermal Release

Three different heating cartridges are uses in this Unit:

- 220 V to 240 V (132 Ohm) 2M 20 329
- 120 V / 127 V (33 Ohm) 2M 20 331
- 100 V (25 Ohm) 2M 20 669

Prolonged heating cartridges are in use since 1992. When installing these heating cartridges lock them using an M4-screw.



### 8.1.3.3 Thermostatic Switch

A safety thermostat which has been tripped must be replaced, no soldering permitted. Prior to replacement, determine cause for tripping, for example:

- wrong heating cartridges
- device assembled incorrectly

The resistance of the thermostat can be checked at its contacts.

### 8.1.4 Boiler with Water heating and Thermostatic Switch

The boiler system is a plug-in unit consisting of:

- Aluminum housing 2M 20 291
- Heating cartridge for 230 V, 120 V / 127 V or 100 V
- Cap for vaporizer 2M 20 292
- O-ring cap 2M 08 777

- Thermostatic switch water shortage alarm 115 °C 2M 20 381
- Safety thermostat 140 °C 2M 20 382
- Plug-in connector

All components can be replaced in the event of repair. If the safety thermostat has been tripped both thermostatic switches must be replaced.

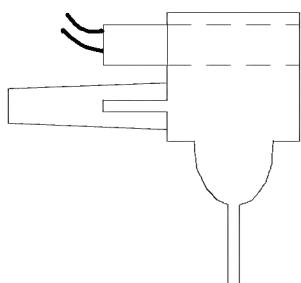
**Service:**

The condition of the boiler housing must be checked every six months. If the vaporizer chamber is soiled it can be scraped out.

**Heating cartridges:**

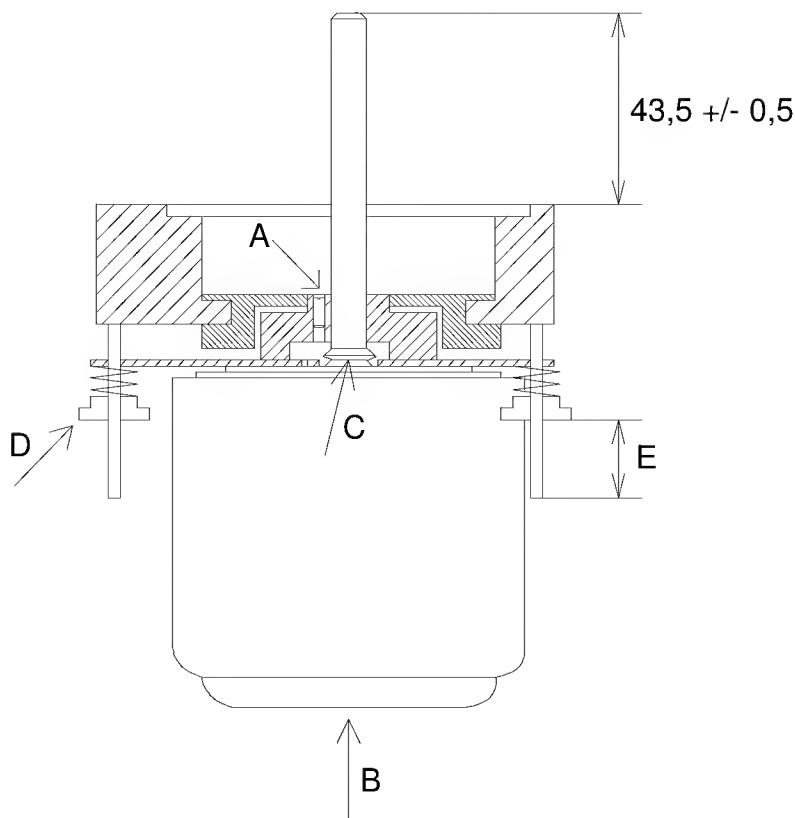
- 220 V to 240 V (530 Ohm) 2M 20 327
- 120 V / 127 V (132 Ohm) 2M 20 328
- 100 V (100 Ohm) 2M 20 668

Prolonged heating cartridges are in use since 1992. As before, the end of the heating cartridge must be flush with the boiler housing.



### 8.1.5 Fan Motor

Fan motor (simplified representation):



#### Service required:

The fan motor must be lubricated every six months with oil 2M 07 839. Procedure: Remove screw **A** located next to the motor shaft and apply approx. 10 drops of oil into the bore hole.

#### Bearing play:

The bearing play can be adjusted using screw **B**. The screw must be adjusted such to allow a motor shaft play of approx. 0.2 mm. The screw must be sealed with locking compound.

## Replacing the Fan Motor

### Procedure:

- Interrupt mains connection to Incubator and remove Unit
- Unscrew coil of the fan watchdog from aluminum block of the motor mount
- Disconnect cable connection from motor to printed circuit board
- Unscrew fixing bracket underneath the motor
- Measure and write down dimension **E** of the 4 retaining screws **D**
- Remove 4 retaining screws **D**
- Using oil 2M 07 839 lubricate later bearing surface of V-ring **C** of the new motor
- Plug new motor with springs onto threaded pins and screw 4 retaining screw **D** onto dimension **E**
- Precision adjustment:  
While the Unit is in its working position the motor shaft must protrude by 43.5 +/- 0.5 mm from the top edge of the aluminum block and must be positioned perpendicularly to the block. The motor must be suspended freely on the springs.
- Seal the 4 retaining screws **D** with Loctite 221.
- Lubricate the motor
- The remaining steps of the installation are performed in the reverse order
- When connecting the grounding rings make sure that they do not protrude from the edge of the resilient motor retaining plate. The flat head screws of the motor retaining clip must be sealed with locking compound.
- After installation into the Incubator make sure that the fan wheel does not rub against the tank and that it can move freely on the spring-loaded bearing.

### **8.1.6 Mains Transformer**

- Transformer with Efen sensor 82 90 426

The test procedure is described under 8.1.8.3

### **8.1.7 Semiconductor Relay**

The test procedure is described under 8.1.8

The following spare parts can be used in the event of repair:

- Semiconductor relay (electromagnetic or crydom 18 31 399  
partial interference suppression)
- Semiconductor relay 18 21 148

Note: The semiconductor relays 18 31 399 have a better switching behavior.

### 8.1.8 Test of Heating Unit (Complete).

## 8.1.8.0      **Contents**

- 8.1.8.1 Test equipment required
- 8.1.8.2 Preparation of test
- 8.1.8.3 Test of power-up relay and supply voltages
- 8.1.8.4 Test of fan monitoring
- 8.1.8.5 Test of relay K4
- 8.1.8.6 Test of relay K3
- 8.1.8.7 Test of relay K2, air heating and feedback air heating
- 8.1.8.8 Test of relay K2, water heating and thermo-switch
- 8.1.8.9 Test of heating unit inside incubator

### 8.1.8.1 Test equipment required

- Tester heating unit Inc. 8000 79 01 764
- Multimeter 79 01 021
- Measuring line, red 1 m 79 01 022
- Measuring line, black, 1m 79 01 023
- Mains line (only if heating unit is disassembled for test)
- 40-pole ribbon cable use the one of incubator or "test board uni 40" 79 00 610
- 10-pole ribbon cable included in tester "heating unit" Inc. 8000" 79 01 764 or use the one of "test board uni 40" 79 00 610

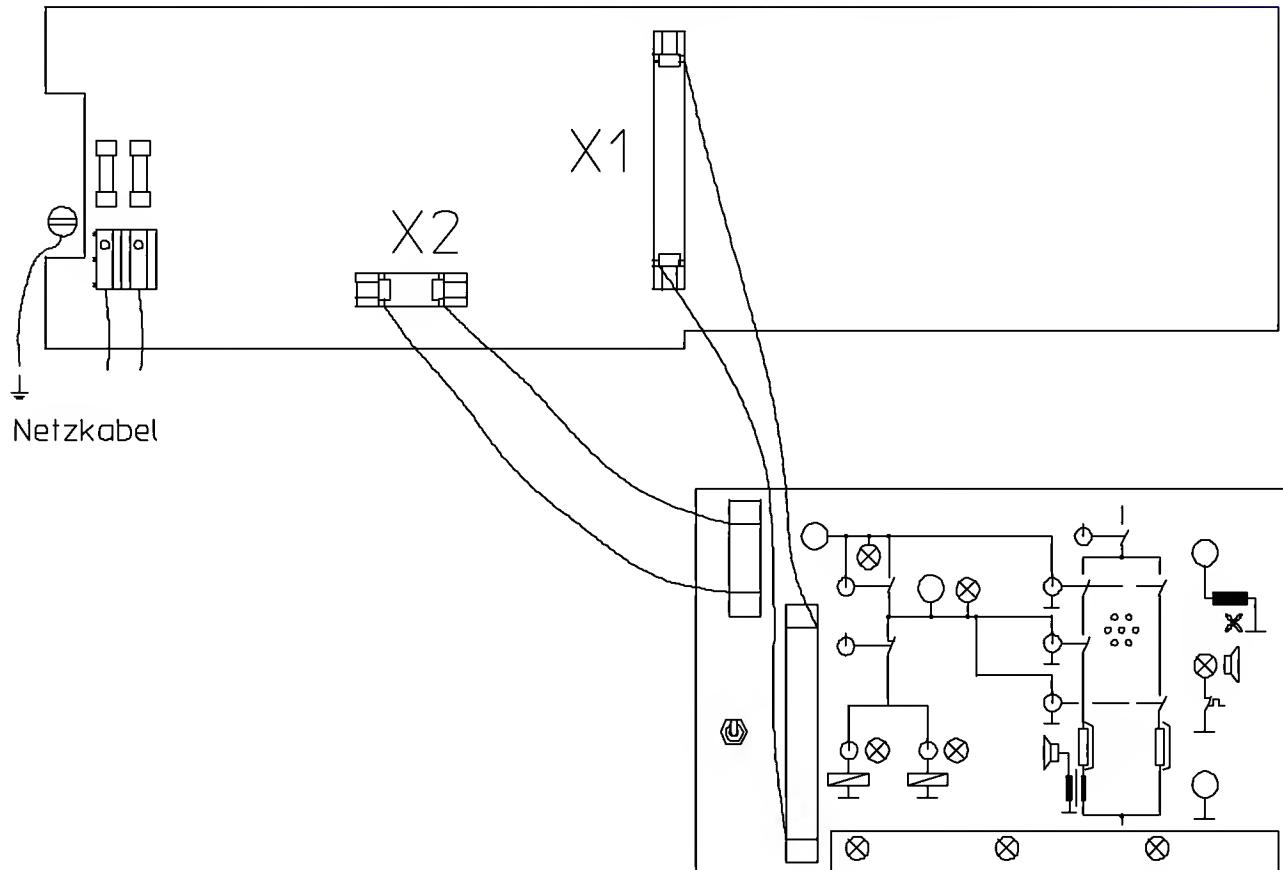
### 8.1.8.2 Preparation of test

The heating unit of Incubators 8000 SC/ICNC can be tested while assembled or disassembled.

Note: If the unit is disassembled an isolating transformer must be used.

Test set-up (Netzkabel = power cord):

PCB Unit (part of the heating unit)



- Interrupt mains connection
- Connect tester to X1 PCB Unit using cable
- Connect tester to X2 PCB Unit, the cable connection to the valve(s) must be interrupted before
- Set all switches at tester to "0" (off)
- Interrupt water supply to boiler of the heating unit
- Attach fan wheel

- Establish mains connection to incubator (heating unit installed) respective to heating unit (not installed)

Set switch K1 at tester to "1" (on).

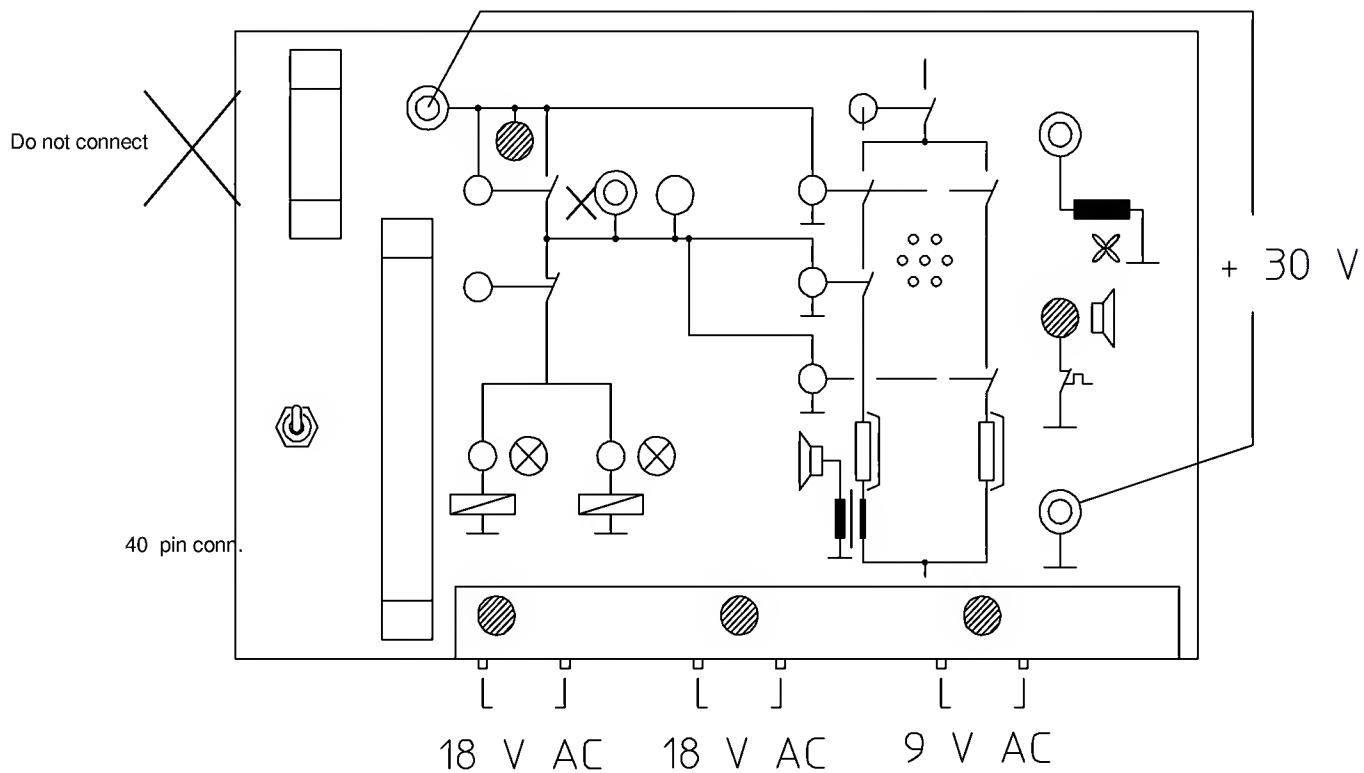
- Action inside the heating unit
  - o Mains power-up relays K1/K5 (heating unit 82 90 511) on
  - o Fan wheel turns
- Test of tester displays:
  - o LED + 30 V lights up
  - o LED 18 V ~ F5 lights up
  - o LED 18 V ~ F6 lights up
  - o LED 9 V ~ F7 lights up

### 8.1.8.3 Test Set-up for testing a Unit in the Field

It is possible to use the following test-set up for testing the power unit in the field:

- open up the unit
- disconnect the electronic module
- connect the power unit and the test box with the 40 pin cable
- carry out the test procedures as given in the following pages (i.e. item 8.1.8.3 and onwards)

Note: The 3 LEDs marked  in the drawing below are not active in this test-setup.



- Measurement of supply voltages at tester
  - o alternating voltage 18 V ~ F5  
test value:  $U = 18 \text{ V} \pm 15 \%$
  - o alternating voltage 18 V ~ F6  
test value  $U = 18 \text{ V} \pm 15 \%$
  - o alternating voltage 9 V ~ F7  
test value  $U = 9 \text{ V} \pm 15 \%$

- o direct voltage + 30 V  
test value U = 30 V  $\pm$  4 V

Possible errors:

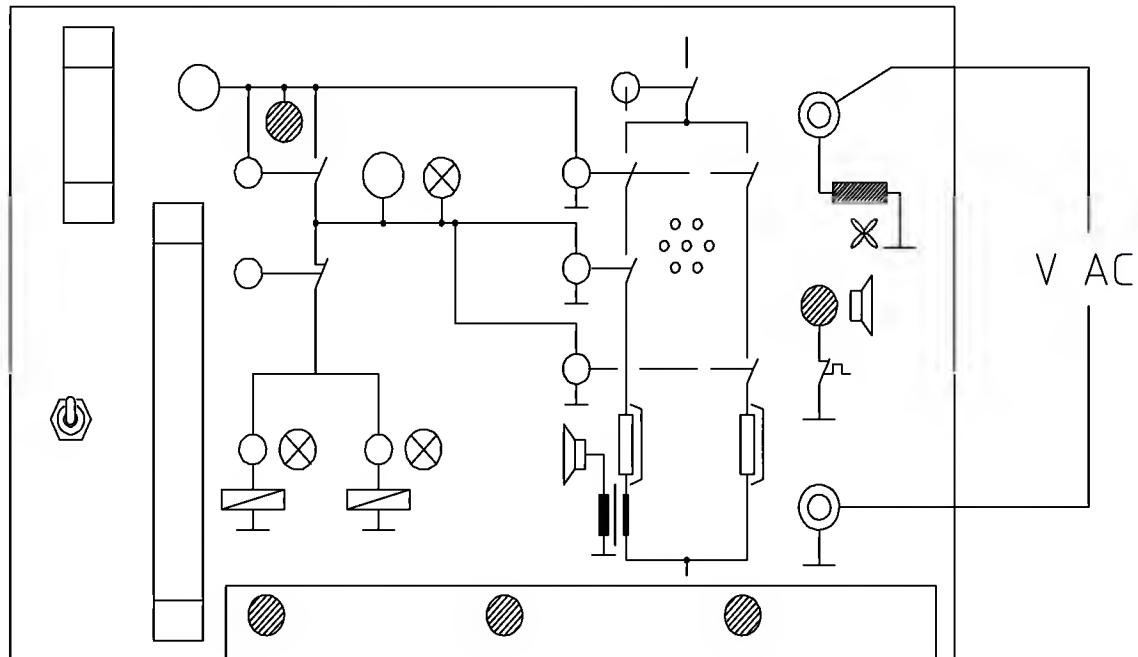
Error	Possible cause
no reaction after switching of K1	<ul style="list-style-type: none"> <li>- mains input fuses F1/F2 defective</li> <li>- fuse F3, F9 or F10 of auxiliary mains transformer defective (F9 and F10 only on PCB 82 90 511)</li> <li>- mains power-up relay K1 or. K1/K5 defective</li> <li>- fuse F4 for mains transformer defective</li> <li>- mains auxiliary transformer or rectifier behind mains auxiliary transformer on PCB defective</li> <li>- Efen sensor of transformer defective</li> </ul>
LED 18 V ~ F5 off or voltage outside the tolerance	<ul style="list-style-type: none"> <li>- fuse F5 defective</li> <li>- transformer defective</li> <li>- voltage changeover to PCB O.K.?</li> </ul>
LED 18 V ~ F6 off or voltage outside the tolerance	<ul style="list-style-type: none"> <li>- fuse F6 defective</li> <li>- transformer defective</li> <li>- voltage changeover to PCB O.K.?</li> </ul>
LED 9 V ~ F7 off or voltage outside the tolerance	<ul style="list-style-type: none"> <li>- fuse F7 defective</li> <li>- transformer defective</li> <li>- voltage changeover to PCB O.K.?</li> </ul>
LED + 30 V off, fan wheel stops	<ul style="list-style-type: none"> <li>- fuse F8 defective</li> <li>- transformer defective</li> </ul>
LED + 30 V off, fan wheel turns	<ul style="list-style-type: none"> <li>- rectifier for + 30 V on PCB defective, alternating voltage exists, because fan wheel turns</li> </ul>
LED + 30 V lights up, fan wheel stops	<ul style="list-style-type: none"> <li>- fan motor defective</li> <li>- starting capacitor for fan motor defective</li> </ul>

Troubleshooting:

component to be tested	test
fuses	resistance measurement with disassembled fuses
mains auxiliary transformer and rectifier behind mains auxiliary transformer	voltage measurement on the PCB via capacitor C2, test value approx. 12 V
Efen sensor transformer	If after switch on the voltage on the PCB exists in front of the transformer, and no LED lights up on the tester, the transformer must be replaced. The voltage (mains voltage) is measured on the PCB between the soldering joint for mains voltage adjustment and fuse F4.

#### 8.1.8.4 Test of fan monitoring

Prepare test as described in 8.1.8.2, test 8.1.8.3 passed.



Switch K1 at tester set to "1" (on), the fan wheel turns.

Measurement of alternating voltage at tester at socket "feedback fan" and GND.

Test value:

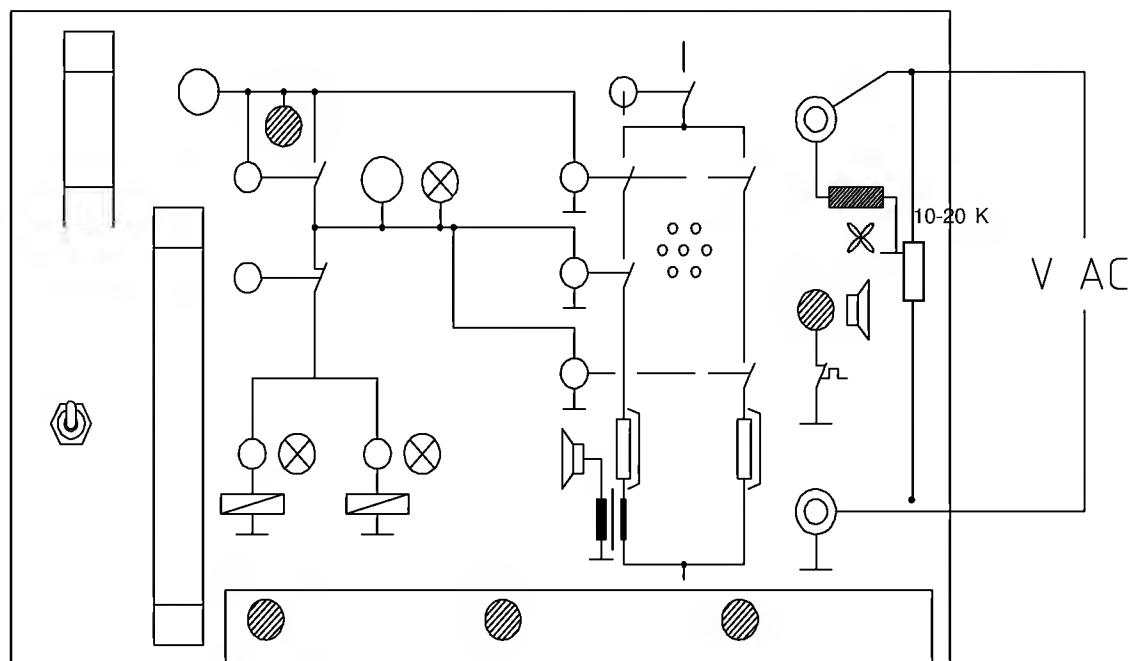
Measurement using an oscilloscope       $V_{ss} > 2,8 \text{ V Peak to Peak}$

in this respect only the negative half-wave is important

or (very inaccurate)

Measurement using multimeter:  $V > 0,6 \text{ V } \sim$

In the case where a high ohm multimeter is used, measure over a 10-20 KOhm resistor as follows:



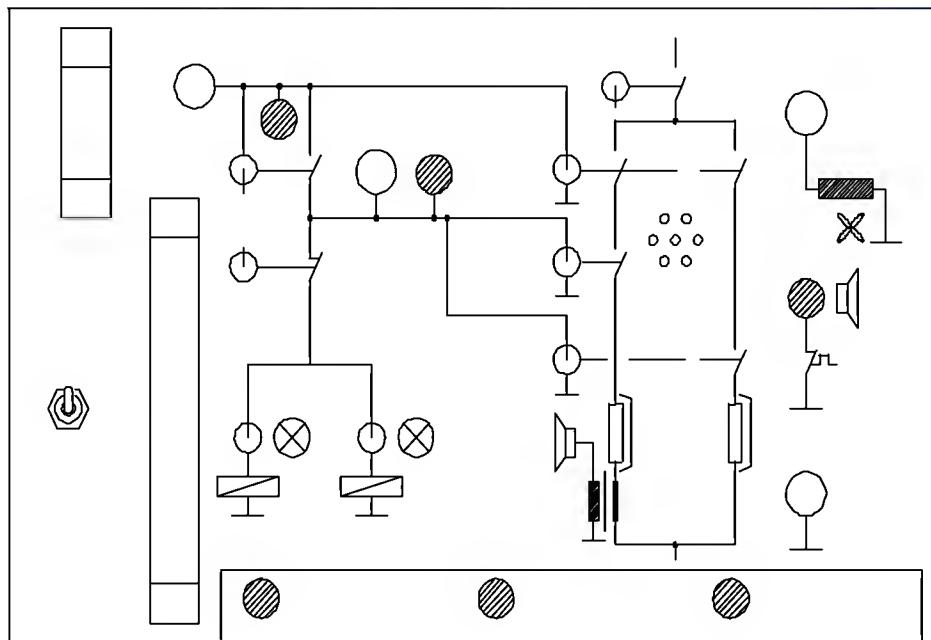
Note: Observe service information No. 29 in case of electronics module Incubator 8000 with PCB Motherboard 82 00 850, otherwise an excess output voltage might result in INOP error 9.

Possible errors:

<b>Error</b>	<b>possible cause</b>
Voltage cannot be measured	<ul style="list-style-type: none"><li>- fan wheel properly attached?</li><li>- cable connection of PCB to coil of fan monitoring interrupted</li><li>fan monitoring interrupted</li><li>- coil of fan monitoring defective (measure voltage directly at the coil with the heating unit disassembled)</li></ul>
voltage too low	observe service information No. 1 (Inc. 8000SC/IC) and service information No. 31 (Inc. 8000), with Inc. 8000 observe service information No. 29!
voltage ok, but continuous fan failure alarm at the assembled incubator	PCB Motherboard in electronics module
INOP-error 9 with assembled Incubator 8000	voltage too high, observe service information No. 29 for Incubator 8000. In Incubator 8000 SC/IC this means there is a failure on the PCB Motherboard.

### 8.1.8.5 Test of relay K4

Prepare test as described in 8.1.8.2, test 8.1.8.3 passed.



Switch K1 at tester set to "1" (on), LED "+ 30 V" at tester lights up.

Test:

LED at tester behind switch K4 off

Switch K4 at tester set to "1" (on)

Test:

LED at tester behind switch K4 lights up

Switch K4 at tester set to "0" (off)

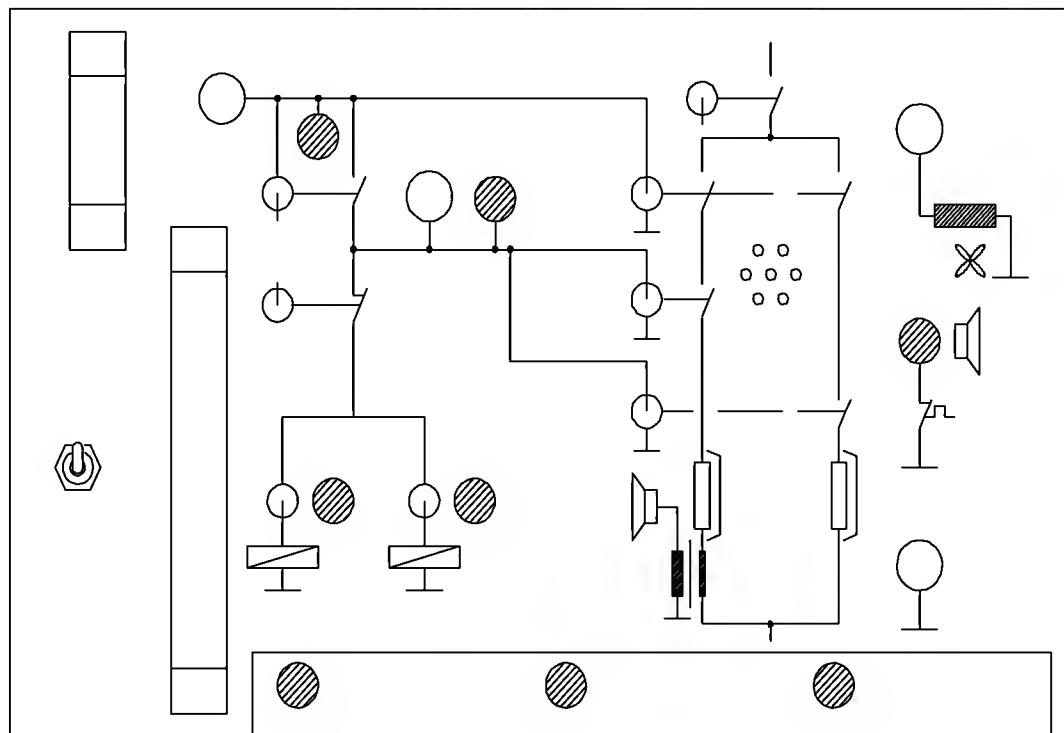
Note: The voltage behind the switching contacts of relay K4 can be measured at the socket behind switch K4 at the tester.

Possible errors:

Error	possible cause
LED always off or no voltage	relay K4 defective
LED continuously lights up or voltage exists continuously	relay K4 defective

### 8.1.8.6 Test of relay K3

Prepare test as described in 8.1.8.2, tests 8.1.8.3 and 8.1.8.5 passed.



Switch K1 and K4 at tester set to "1" (on), LED "+ 30 V" lights up.

Switch V1 and V2 set to "1" (on)

Test: LED V1 and V2 at tester light up.

Switch K3 at tester set to "1" (on)

Test: LED V1 and V2 off

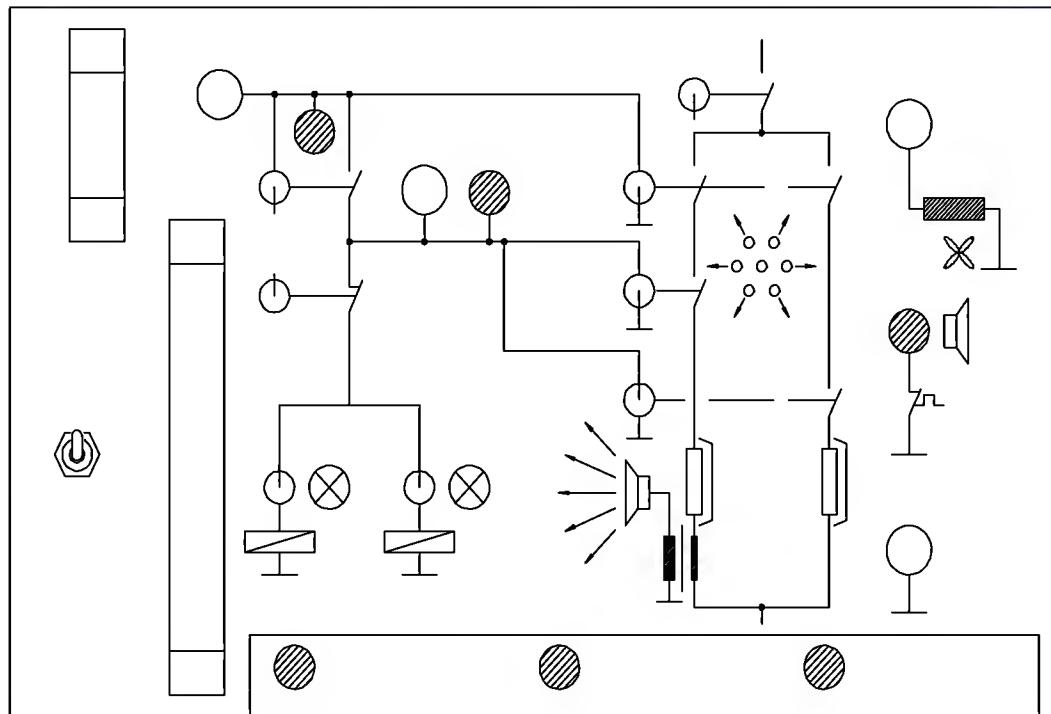
Switch K3 at tester set to "0" (off)

Possible errors:

Error	possible cause
LED V1 or V2 continuously light up	relay K3 defective
LED V1 or V2 continuously off	relay K3 defective

### 8.1.8.7 Test of relay K2, air heating and feedback air heating

Prepare test as described under 8.1.8.2, tests 8.1.8.3 and 8.1.8.5 passed.



Switch K1 and K4 at tester set to "1" (on)

Switch K2 and HLR1 at tester set to "1" (on)

Test:

Horn (high frequency) in tester on, air heating gets warm (do not allow to become too hot, at 350 °C the thermostatic switch operates)

Switch K2 set to "0" (off), the relay interrupts the power supply to the air heating

Test: Horn in tester off

Switch K2 set to "1" (on)

Test: Horn in tester on

Switch HLR1 set to "0" (off), the semiconductor relay of the air heating is switched off

Test: Horn in tester off

Possible errors:

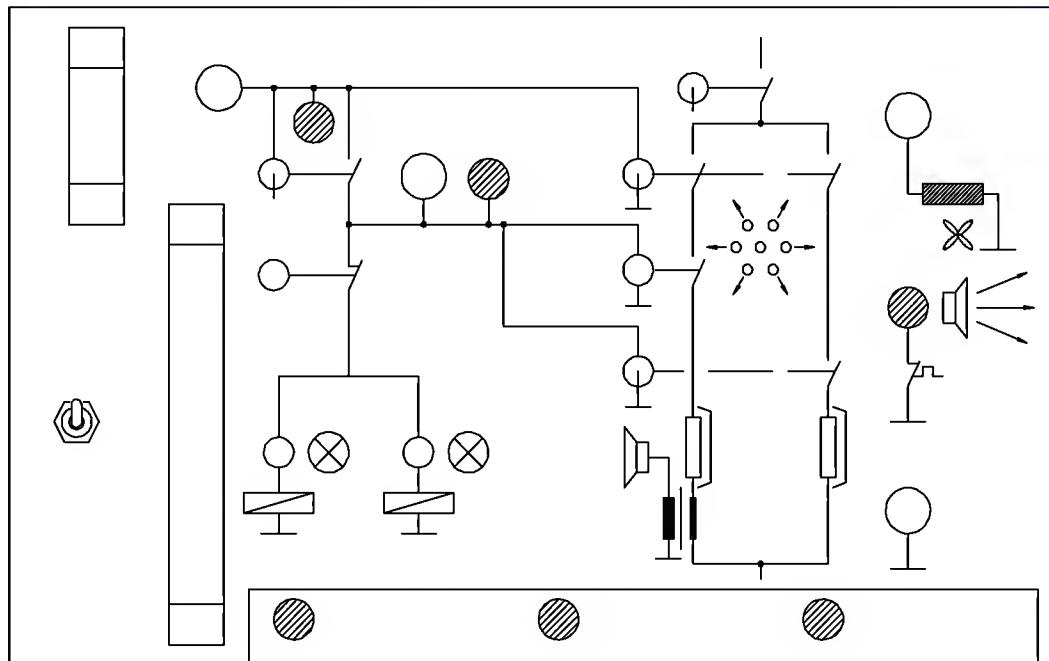
Error	possible cause
horn continuously off	<ul style="list-style-type: none"> <li>- relay K2 defective</li> <li>- HLR1 of air heating defective</li> <li>- air heating defective (highly ohmic)</li> <li>- thermostatic switch of air heating operates</li> <li>- feedback defective (line interrupt)</li> </ul>
horn cannot be switched off with K2	relay K2 defective
horn cannot be switched off with HLR1	semiconductor relay HLR1 of air heating defective

Troubleshooting:

Component to be tested	Test
Thermostatic switch air heating	Resistance measurement approx. 0 Ohm, defective switches must be replaced
Air heating	<p>Resistance measurement, different types of heating cartridges may be used:</p> <ul style="list-style-type: none"> <li>- 132 Ohm (230 V / 240 V)</li> <li>- 33 Ohm (120V / 127 V)</li> <li>- 25 Ohm (100V)</li> <li>- 2 x 60 Ohm (230/115 V)</li> </ul>
Semiconductor relay HLR1 for air heating	<p>For this bridge contacts of relay K2 on the PCB via the test points:</p> <ul style="list-style-type: none"> <li>- PCB 82 90 511 and PCB 82 00 600 <math>\geq 4</math>: bridge test points T55 and T57</li> <li>- PCB 82 00 600 - 3: bridge between fuse holder F2 and solder tag T6 (connection air heating)</li> </ul> <p>Switch on heating via tester (as described in the test above); however, heating cannot be switched off via K2.</p>
Relay K2	<p>For this bridge HLR1 of air heating at the mains side directly at HLR at connections 1 and 2. The front relay is the HLR for the air heating.</p> <p>Switch on heating via tester (as described in the test above), however, the heating cannot be switched off via K2</p>

### 8.1.8.8 Test of relay K2, water heating and thermostatic switch

Prepare test as described under 8.1.8.2, tests 8.1.8.3 and 8.1.8.5 passed.



Switch K1 and K4 at tester set to "1" (on)

Test: LED "H<sub>2</sub>O-shortage" shows green light

Switch K2 and HLR2 set to "1" (on)

Test: Boiler gets warm, after approx. 5 to 15 minutes horn on and LED "H<sub>2</sub>O-shortage" shows red light

Switch HLR2 at tester set to "0" (off)

Test: After 5 minutes max. horn off, LED "H<sub>2</sub>O-shortage" at tester shows green light again

Repeat all test steps

Possible errors:

Error	possible cause
Boiler does not heat up, LED "H <sub>2</sub> O-shortage" continuously shows green light	<ul style="list-style-type: none"> <li>- excess temperature switch at heating switched off</li> <li>- heating cartridge defective (highly ohmic)</li> <li>- relay K2 defective</li> <li>- HLR2 of water heating defective</li> </ul>
Boiler heats up, LED "H <sub>2</sub> O-shortage" continuously shows green light	thermostatic switch water shortage defective (always closed)
LED "H <sub>2</sub> O-shortage" continuously shows red light	thermostatic switch water shortage defective (always open)
Boiler cannot be switched off by means of switch "HLR2"	HLR2 defective

Troubleshooting:

component to be tested	test
excess temperature switch	<p>resistance test at resettable thermostatic switch at boiler (approx. 0 Ohm). If switch has operated both thermostatic switches at the boiler must be replaced.</p>
Semiconductor relay HLR2 of water heating	<p>For this, bridge contacts of relay K2 on the PCB via the test points:</p> <ul style="list-style-type: none"> <li>- PCB 82 90 511 and PCB 82 00 600 ≥ 4: Bridge test points T55 and T58</li> <li>- PCB 82 00 600 -3: bridge between fuse holder F2 and solder tag T11 (connection water heating)</li> </ul> <p>Switch on heating via tester (as described in the test above), however the heating cannot be switched off via K2</p>
Relay K2	<p>For this, bridge HLR2 on the mains side directly at HLR at connection 1 and 2. The HLR of the water heating is the back relay. It must be possible to switch on the heating via the tester, however, it cannot be switched off by means of switch "HLR2", but only with switch K2.</p>

### 8.1.8.9 Test of heating unit in the incubator

Assemble incubator in operable condition and switch it on.

Test: No INOP or error alarm after switch-on test

Perform O2 calibration (not Inc. 8000 SC/NC) and increase O2-desired value by at least 5 % by vol. compared to actual value

Test: No error-alarm in O2-module

Set humidity desired value to maximum:

Test with water supply:

The humidity measured value rises after a few minutes

Test without water supply:

Water-shortage alarm after a few minutes. The heating is switched off by the control, the boiler cools down and the warning is switched off.

Repeat test several times.

Measurement of power consumption of water heating

Measure power consumption of unit. After self-test briefly withdraw and insert the environmental sensor, thus air heating is suppressed for 90 seconds and with switched-on humidity module and at max. desired value now a pulsating current of approx. 0,5 A (230 V to 240 V-units) or of approx. 1 A (100 V to 127 V-units) can be measured.

Note: By pressing the two desired value buttons in the humidity module switched on for approx. 3 seconds, a "heating LED" can be called up in the humidity module. Thus the control and the pulsating current can be compared.

### 8.1.8.10 Testing of valves

As a special function the valve of Inc. 8000 IC can be triggered with the tester "heating unit Inc. 8000".

Prepare test set up as described in 8.1.8.2, but connect valve(s) to X2 on the PCB Unit, the previous cable connection to the tester is no longer used. The LEDs at the tester for "V1", "V2" and the LED behind K4 do not have any function now.

For switch-on set the following switches at the tester to "1" (on): K1, K4 and V1 or V2

### 8.1.9 Voltage Selection

**Caution: The electrical height adjustment is only intended for a voltage range of (100 V to 127 V or 220 V to 240 V)! In Incubator 8000 SC/IC/NC also observe mains input fuses!**

The following circuit must be modified on the PCB 82 90 511:

- Solder jumper on printed circuit board into desired mains voltage position, refer to 8.1.2 Layout. There are several versions available, therefore the marking for the mains voltages on the printed circuit board shall apply!
- In addition, the following soldering jumpers for the auxiliary transformer need to be soldered:
  - 220 V to 240 V: soldering jumper T42 ↔ T43
  - 100 V to 127 V: soldering jumpers T41 ↔ T42 and T43 ↔ T44
- Modify fuses on the printed circuit board, refer to 8.1.2.2

The heating cartridge of the air heating must be replaced:

- 220 V to 240 V 2M 20 329
- 120 V /127 V 2M 20 331
- 100 V 2M 20 669

The heating cartridge of the water heating must be replaced:

- 220 V to 240 V 2M 20 327
- 120 V / 127 V 2M 20 328
- 100 V 2M 20 668

## **8.1.10 Replacement of Unit in the event of Repair**

In the event of repair the Units for the Incubators 8000 and 8000 SC/IC/NC can be replaced by the Unit 2M 20 615.

This order number includes heating cartridges, boiler and fuses for 120 V / 127 V. The Unit 2M 20 276 was only intended for one specific mains voltage and is no longer available.

## **8.1.11 Repair Information and Change Status**

### **8.1.11.1 Boiler for Inc. 8000 SC/IC in Unit 2M 19 940 for Inc. 8000**

The boiler system for Inc. 8000 is considerably easier to service. The boiler housing can be replaced at considerably less cost. For servicing purposes it is still necessary to remove the Unit because the housing of Incubator 8000 has no servicing flap.

The following parts are required for modification:

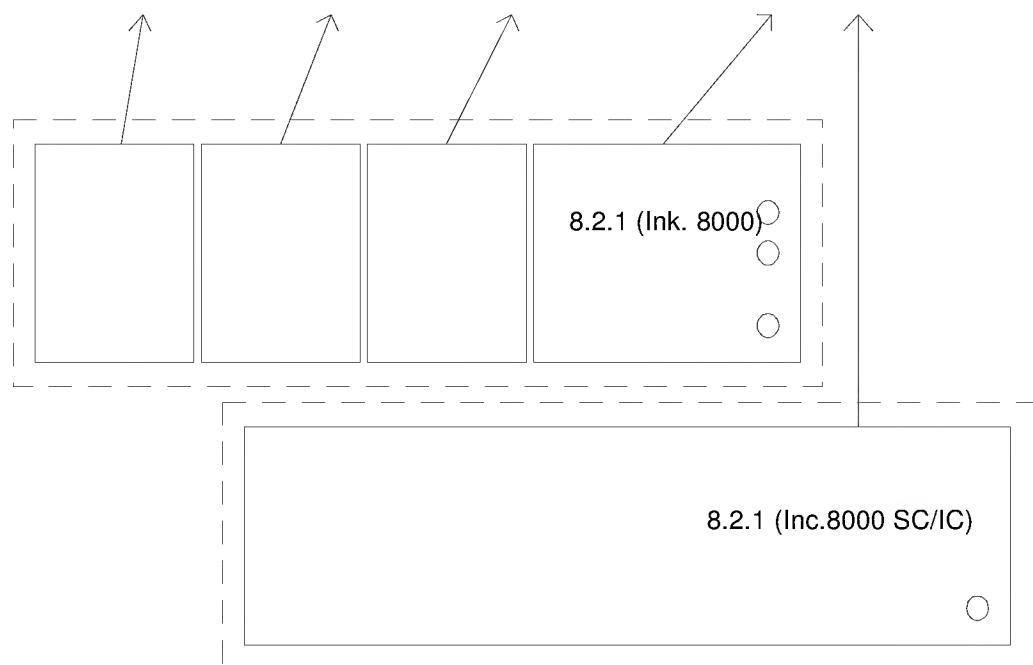
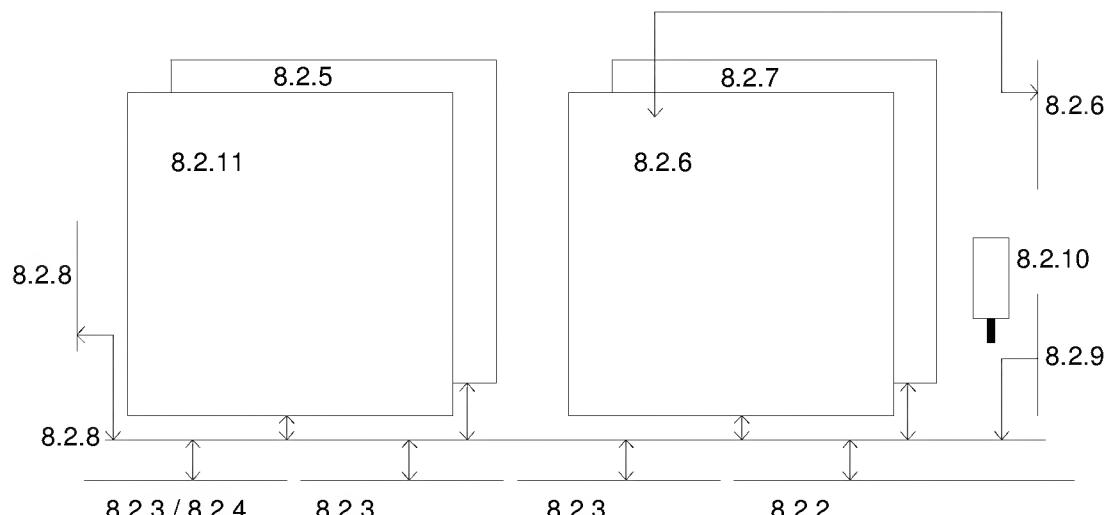
- Boiler modification kit 2M 20 680
- Boiler (complete) 230 V / 240 V 2M 20 618 or
- Boiler (complete) 120 V / 127 V 2M 20 619

The modification kit will be available as of approx. September 1993.

## 8.2 Electronics module

### 8.2.0 Table of Contents

Position of the sub-assemblies in the electronics module:



- 8.2.1 Keyboards, Inc. 8000 NC/SC/IC
- 8.2.2 PCB Display Air Temperature
- 8.2.3 PCB Display (of options), PCB Display Skin
- 8.2.4 PCB Display Humidity (only Inc. 8000 SC/NC)
- 8.2.5 PCB CPU and Software-Information
- 8.2.6 PCB Analog and PCB Filter
- 8.2.7 PCB Power Pack and Voltage Controller
- 8.2.8 PCB Motherboard and PCB Fan
- 8.2.9 PCB Switch
- 8.2.10 Push Buttons for Height Adjustment (only Inc. 8000)
- 8.2.11 PCB Controller (RS232)

## 8.2.1 Keyboards

### 8.2.1.0 Table of Contents

- 8.2.1.1 Information about keyboards used
- 8.2.1.2 N/A
- 8.2.1.3 Keyboards Incubator 8000 SC/IC/NC
- 8.2.1.4 Test
- 8.2.1.5 Exchange in case of repair
- 8.2.1.6 Repair information and change status

### 8.2.1.1 Information about keyboards used

Different keyboards are used in the Incubators:

#### Incubator 8000 SC/IC/NC:

- Inc. 8000 IC with skin temperature control
- Inc. 8000 IC without skin temperature control
- Inc. 8000 SC/NC with skin temperature control
- Inc. 8000 SC/NC without skin temperature control

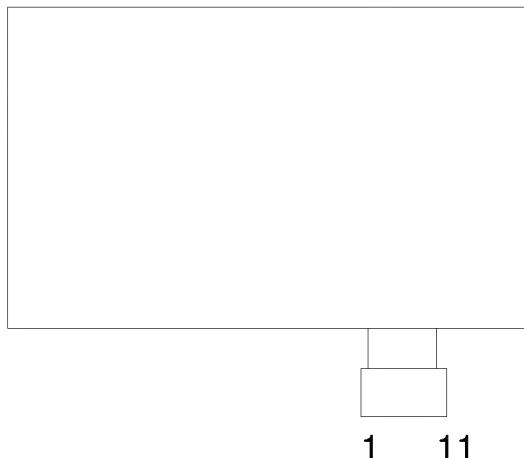
The keyboard is connected to the PCB Display Air Temperature and is read out therefrom. The keyboard is structured like 4 or 3 individual keyboards of Inc. 8000, but with one cable connection only.

### 8.2.1.2 N/A

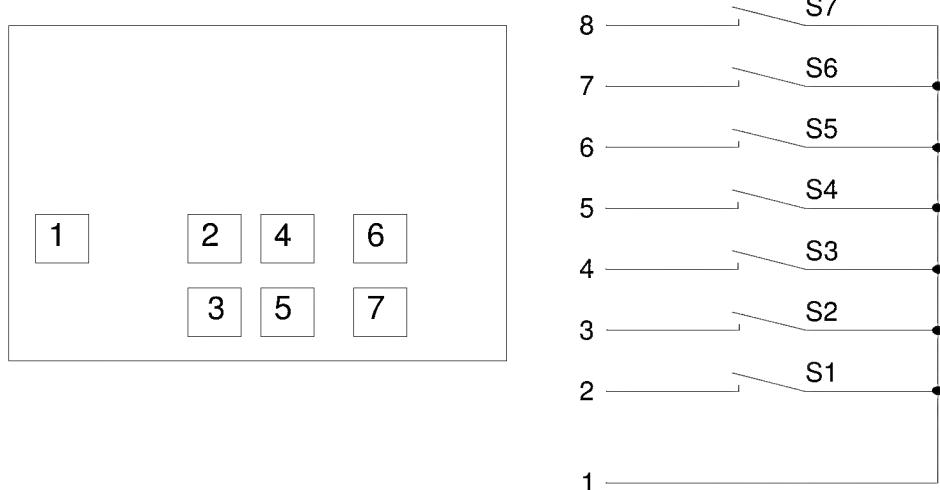
### 8.2.1.3 Keyboards of Incubator 8000 SC/IC/NC

The keyboard is to be seen like 3 or 4 individual keyboards.

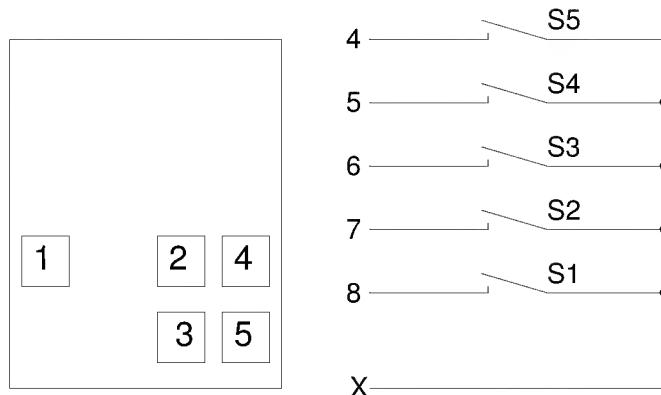
Pin assignment:



Field for air temperature control:



Field for humidity, oxygen and skin temperature:



Note: "Foot symbol" key (where fitted) is S4.

Module	X = Pin terminal
Skin temperature	Pin 9
Oxygen	Pin 10
Humidity	Pin 11

The keyboard switches can be tested ohmically.

#### 8.1.1.4 Test

All keyboards can be tested ohmically, please refer to 8.1.1.3. In assembled condition the following tests can be performed:

If a key is identified as being pressed for more than 30 seconds an error storage (potential INOP or Err-message) is performed.

#### 8.2.1.5 Exchange in case of repair

The keyboards cannot be repaired and must be replaced in case of an error. The following spare parts are available:

##### Keyboards of Incubator 8000 IC:

Software version	For units	Keyboard
20.nn (old)	w/o skin-temperature meas.	82 90 470
20.nn (old)	with skin-temperature meas. (1 measurement channel)	Currently 2 possibilities: - 82 90 467 (discontinued type)

		<ul style="list-style-type: none"> <li>- 2M 21 681</li> </ul> <p>Important for use of 2M 21 681 in units which used to have a different keypad:</p> <ul style="list-style-type: none"> <li>- Use strip supplied to deactivate key for second skin-temperature channel.</li> <li>- On display PCB (82 90 431) for skin, remove third LED from top, as there is no hole for this in the new keyboard.</li> </ul>
21.nn (new)	w/o skin-temperature meas.	82 90 470
21.nn (new)	with skin-temperature meas., 1 measurement channel	<p>2M 21 681</p> <p>Important: Use strip supplied to deactivate key for second skin-temperature channel. Please order the sticker 2M 21 921 always in addition to the spare parts keypad or electronics module for US units with ThermoMonitoring.</p>
21.nn (new)	with skin-temperature meas., 2 measurement channels (ThermoView)	<p>2M 21 681</p> <p>Important: Use strip supplied to activate key for second skin-temperature channel. Please order the sticker 2M 21 921 always in addition to the spare parts keypad or electronics module for US units with ThermoMonitoring.</p>

#### Keyboards of Incubator 8000 SC/NC:

Software version	For units	Keyboard
10.nn (old)	w/o skin-temperature meas.	<p>For SC and NC with central alarm LED:</p> <ul style="list-style-type: none"> <li>- 2M 21 182</li> </ul> <p>or only for SC (discontinued type) w/o central alarm LED labeled „Incubator 8000 SC“:</p> <ul style="list-style-type: none"> <li>- 82 90 419</li> </ul> <p>Note: The central alarm LED is not served by SW 10.nn and is also not described in operating instructions.</p>
10.nn (old)	with skin-temperature meas. (1 measurement channel)	Currently several possibilities: For SC and NC without central alarm

		<p>LED:</p> <ul style="list-style-type: none"> <li>- 2M 21 180 (discontinued type)</li> </ul> <p>or only for SC (discontinued type) w/o central alarm LED labeled „Incubator 8000 SC“:</p> <ul style="list-style-type: none"> <li>- 82 90 415</li> </ul> <p>In future for all SC and NC with central alarm LED:</p> <ul style="list-style-type: none"> <li>- 2M 21 691</li> </ul> <p>Important for use of 2M 21 691 in units which used to have a different keyboard:</p> <ul style="list-style-type: none"> <li>- Use strip supplied to deactivate key for second skin-temperature channel.</li> <li>- On display PCB (82 00 650 or 82 90 431) for skin, remove third LED from top, as there is no hole for this in the new keyboard.</li> </ul> <p>Note: The central alarm LED is not served by SW 10.nn and is also not described in operating instructions.</p>
11.nn (new)	w/o skin-temperature meas.	<p>For SC and NC with central alarm LED:</p> <ul style="list-style-type: none"> <li>- 2M 21 182</li> </ul>
11.nn (new)	with skin-temperature meas., 1 measurement channel	<p>2M 21 691</p> <p>Important: Use strip supplied to deactivate key for second skin-temperature channel.</p>
11.nn (new)	with skin-temperature meas., 2 measurement channels (Thermomonitoring)	<p>2M 21 691</p> <p>Important: Use strip supplied to activate key for second skin-temperature channel.</p>

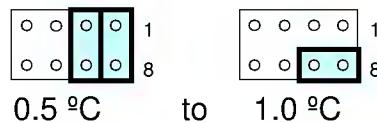
### 8.2.1.6 Repair information and change status

**Re:** **Change of skin temperature deviation alarm from 0.5 to 1.0 °C for all US versions of Incubator 8000 IC with ThermoMonitoring**

**Reason:** All US versions Incubator 8000 IC with ThermoMonitoring for the USA and Canada will be delivered with a skin temperature deviation alarm limit of 1.0 °C according the US version of the Operating Instructions of the Incubator 8000 IC Software Version 21.n.

**Solution:** For this change the following modification is necessary:

1. Place a sticker "  $\pm 1$  °C " with the order no. 2M 21 921 on the keypad of the skin temperature control module directly over the "  $\pm 0.5$  °C " label.
2. Change the jumper configuration X5 on the Analog PCB 82 90 680 from:



**Devices affected:** All Incubators 8000 IC as of software version 21.n in the USA and Canada.

**Additional info:** Please order the sticker 2M 21 921 "  $\pm 1$  °C " always in addition to the spare parts keypad or electronics module.

## 8.2.2 PCB Display Air Temperature

### 8.2.2.0 Table of Contents

- 8.2.2.1 Information about PCB Display Air Temperature used
- 8.2.2.2 N/A
- 8.2.2.3 PCB Display Air Temperature 82 90 411 (Inc. 8000 SC/IC/NC)
- 8.2.2.4 Test
- 8.2.2.5 Exchange in case of repair
- 8.2.2.6 Repair information and change status

### 8.2.2.1 Information About PCB Display Air Temperature Used

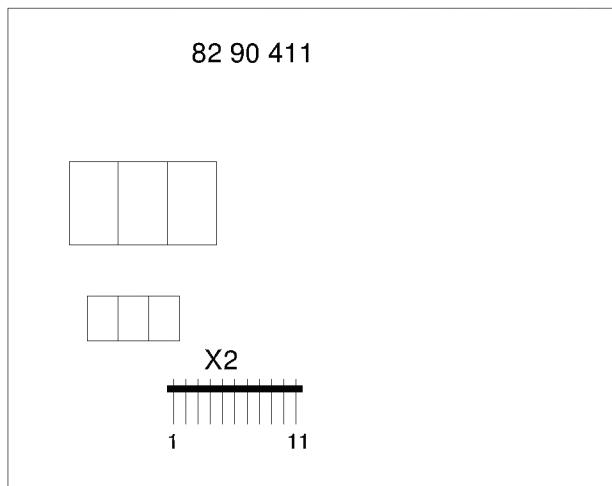
#### PCB Display Air Temperature 82 90 411 (of Inc. 8000 SC/IC/NC)

With this PCB **all** keyboards of Incubator 8000 and 8000 SC/IC/NC can be connected. In case of repair this PCB can be installed in all Incubators 8000 and 8000 SC/IC/NC, please refer to 8.2.3.5 "Exchange in case of repair".

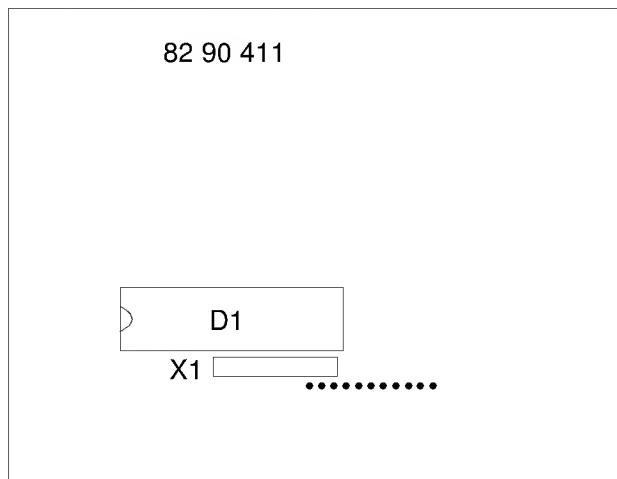
#### 8.2.2.2 N/A

### 8.2.2.3 PCB Display Air Temperature 82 90 411

Layout connection side for keyboard:



Layout component mounting side:



Configuration:

Position	Component
X1	Connection to motherboard
X2	Connection to keyboard
D1	Keyboard and display driver 18 20 877

### 8.2.2.4 Test

**Displays:**

All displays, except for the mains failure LED can be tested with the air temperature module by pressing the "Check" key. The LED mains failure only lights up in case of mains failure and the operational LED lights up as soon as the unit is switched on. In the case of an error in the keyboard and display driver an INOP message is given.

**Keyboard evaluation:**

The keys can be simulated by short-circuiting of connections (keys) at connector X2, please also refer to 8.2.1.2 and 8.1.2.3. When short-circuiting the keys or in the event of a short-circuit on the PCB for more than 30 seconds an error is stored (does not apply to SW 0.4 of Inc. 8000).

**8.2.2.5 Exchange in case of repair**

- PCB Display Air Temperature 82 90 411

**8.2.2.6 Repair information and change status****1. Manufacturing fault in the PCB Display Air Temperature 82 90 411 08.94**

Description: Contact problems between this board and the PCB Motherboard due to soldering agent vapors at the plug-in connector X1. The fault is visible at the plug-in connector:

OK = contacts are gleaming gold  
Not OK = contacts are silver gray

Devices

affected: Incubators 8000 SC/IC manufactured between June '92 and end '93.

Measures: No preventive check required since this fault has reportedly occurred only once so far (August 94). Should this type of fault occur, then replace the board.

## 8.2.3 PCB Display (of options), PCB Display Skin (as of SW 11 and 21)

### 8.2.3.0 Table of Contents

- 8.2.3.1 Information about PCBs Display used
- 8.2.3.2 PCB Display 82 00 431 / 82 90 650 / 82 90 691
- 8.2.3.3 Functional adjustment for humidity, oxygen and skin temperature
- 8.2.3.4 Exchange in case of repair
- 8.2.3.5 Test
- 8.2.3.6 Repair instructions and change status

### 8.2.3.1 Information about PCBs Display used

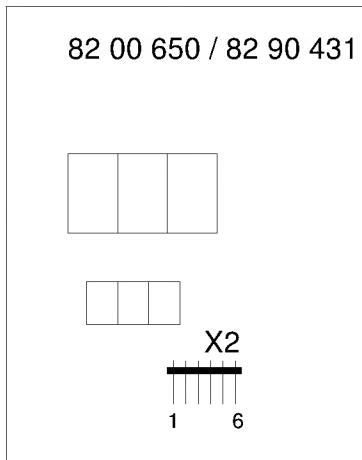
#### Incubator 8000 SC/IC/NC:

- PCB Display 82 90 431
- PCB Display Skin 82 90 691  
(with SW 11.nn and 21.nn)

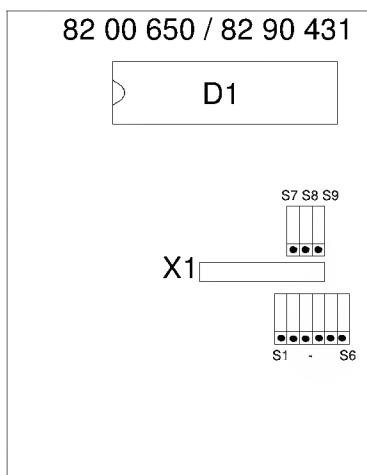
PCB Display Skin 82 90 691 is only intended for skin temperature. It is required with SW 11.nn and 21.nn.

### 8.2.3.2 PCB Display 82 90 431

Layout connection side keyboard:



Layout configuration side:



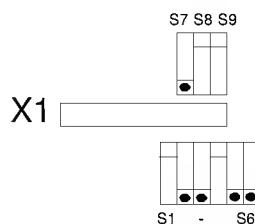
Configuration:

Position	Component
X1	Connection to motherboard
X2	Connection to keyboard of Inc. 8000, unassigned in Inc. 8000 SC/IC/NC
D1	Keyboard and display driver
S1 to S9	Option switch or soldering bridges, refer to 8.2.3.3

### 8.2.3.3 Functional adjustment for humidity, oxygen and skin temperature

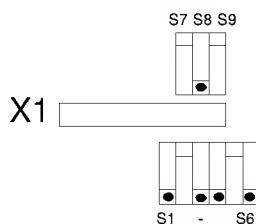
Before installing the PCB Displays, it is necessary to adjust the function of the board using the switches or the soldering bridges S1 to S9. The soldering bridges are located at the same point as the switches.

Skin temperature



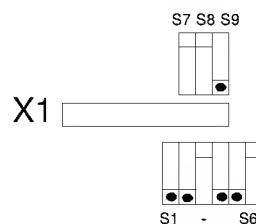
S1, S4 and S7 closed

Oxygen



S2, S5 and S8 closed

Humidity



S3, S6 and S9 closed

### 8.2.3.4 Exchange in case of repair

- PCB Display 82 90 431
- PCB Display Skin 82 90 691

The new PCB Display Skin 82 90 691 is required if the Incubator features the PCB Analog 82 90 680 with SW 11.nn or 21.nn. The difference with respect to the old PCB Display 82 90 431 is that there is a differently positioned LED for the additional key for readout of the second skin-temperature channel. This new PCB Display Skin 82 90 691 can be used on all units IC/SC/NC for skin temperature.

### 8.2.3.5 Test

The display is tested as described in 8.2.2.4 "Test of PCB Display Air Temperature". Note: The keyboards for the options of Incubator 8000 are connected to this PCB, but evaluations takes place on the PCB Display Air Temperature.

### **8.2.3.6 Repair instructions and change status**

#### **1. Manufacturing fault in the PCB Display 82 90 431 08.94**

Description: Display flickers or INOP with display error has occurred.

Cause: Contact problems between this board and the PCB Motherboard due to soldering agent vapors at the plug-in connector X1. The fault is visible at the plug-in connector:

OK = contacts are gleaming gold

Not OK = contacts are silver gray

Devices affected:

Incubators 8000 SC/IC manufactured between June '92 and end '93.

Measures: No preventive check required since this fault has reportedly occurred only once so far (August 94) on the PCB Display Air Temperature 82 90 411. Should this type or fault occur, then replace the board.

#### **2. Soldering switches replace DIL switches 08.94**

As of end 94, the option switches S1 to S9 will be replaced with soldering switches, refer to 8.2.3.5.

### **8.2.4 PCB Display Humidity (only Inc. 8000 SC/NC)**

#### **8.2.4.0 Table of Contents**

8.2.4.1 Description PCB Display Humidity 82 90 451

8.2.4.2 Exchange in case of repair

8.2.4.3 Repair information and change status

#### **8.2.4.1 Description of PCB Display Humidity**

The PCB Display Humidity is almost identical with the PCB Display 82 90 431, but the LEDs, switches and 7-segment displays for Inc. 8000 SC not used are not fitted. Test and layout plan are identical with PCB Display, refer to 8.2.3. The switch or the soldering bridge S9 must be adjusted or bridged as described in 8.2.3.3. The switches S1 to S8 (if available) remain open.

#### **8.2.4.2 Exchange in case of repair**

For repair of the PCB Display Humidity the following spare part may be used:

- PCB Display Humidity 82 90 431

#### **8.2.4.3 Repair information and change status**

##### **1. Manufacturing fault in the PCB Display Humidity 82 90 431 08.94**

Description: Display flickers or INOP with display error has occurred.

Cause: Contact problems between this board and the PCB Motherboard due to soldering agent vapors at the plug-in connector X1. The fault is visible at the plug-in connector:

OK = contacts are gleaming gold  
Not OK = contacts are silver gray

Devices affected: Incubators 8000 SC/IC manufactured between June '92 and end '93.

Measures: No preventive check required since this fault has reportedly occurred only once so far (August 94) on the PCB Display Air Temperature 82 90 411. Should this type of fault occur, then replace the board.

##### **2. Soldering switches replace DIL switches 08.94**

As of end 94, the option switch S9 will be replaced with a soldering switch, refer to 8.2.3.3. This connection must be closed, S1 to S8 must remain open.

## 8.2.5 PCB CPU

### 8.2.5.0 Contents

- 8.2.5.1 Information about PCB CPUs used
- 8.2.5.2 PCB CPU Standard 2
- 8.2.5.3 PCB CPU Incubator
- 8.2.5.4 Test
- 8.2.5.5 Exchange of PCB CPU in the case of repair
- 8.2.5.6 Repair information software
- 8.2.5.7 Repair information and modification states

#### 8.2.5.1 Information about PCB CPUs used

Two different PCB CPUs can be used in Incubator 8000 SC/IC/NC.

PCB CPU Standard 2 (83 05 141)

A Standard-CPU, which is used in several Dräger-devices, e.g. in Incubator 8000 series and EVITA. In the incubator many functions of this PCB are not used..

PCB CPU Incubator 8000 (82 90 571)

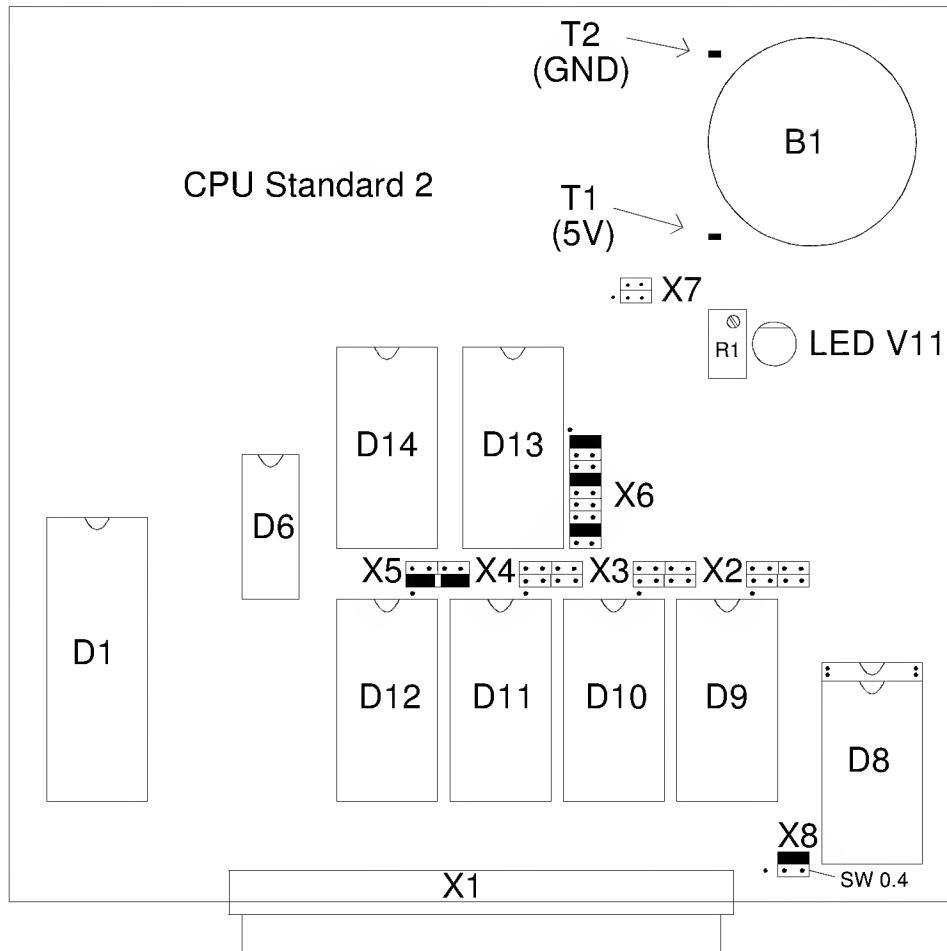
A modified version of the PCB CPU Standard 2, in which components which are not used are not fitted, e.g. the battery for retention of data. This PCB can only be used in Incubator 8000 and Incubator 8000 SC/IC/NC.

**Note:** The PCB CPU Incubator 82 90 571 with the modification status "00" is being replaced by a modification status " $\geq 01$ ", see IDM no. 15 or [TSB no. 12](#).

In the event of repairs both versions can be used. The different fittings are described in in 8.2.5.2 and 8.2.5.3, also refer to 8.2.5.5 "Exchange of PCB CPU in the case of repair.

### 8.2.5.2 PCB CPU Standard 2 (83 05 141)

Layout plan (Drawing shows configuration with software 1x.xx or 2x.xx.):



Configuration of jumper fields with jumper 18 14 508:

Position	SW 1.xx, 1x.xx or 2x.xx
X2	not fitted
X3	not fitted
X4	not fitted
X5	1-2, 3-4 (like drawing)
X6	1-18, 4-15, 8-11 (like drawing)
X7	not fitted
X8	3-4 (like drawing)

Configuration of components:

Component and Position	SW 1x.xx or 2x.xx
D1	Microprocessor 18 09 156
D6	Address decoder 83 04 920
D8	Time-Keeper-RAM 18 28 142 (Pin 1 of component into Pin 3 of base)
D9	not fitted
D10	not fitted
D11	not fitted
D12	EPROM, see 8.2.5.5
D13	Timer 18 13 900
D14	not fitted
B1	not fitted

**Calibration of voltage comparator:**

The voltage comparator on the PCB CPU Standard 2 is not required for Incubator 8000 SC/IC/SC, potentiometer R1 must be turned right until it stops (clockwise).

**Note: If after use of this PCB in the incubator it shall be used in a different device (e.g. Evita) the voltage comparator must be calibrated to the value of the respective unit before.**

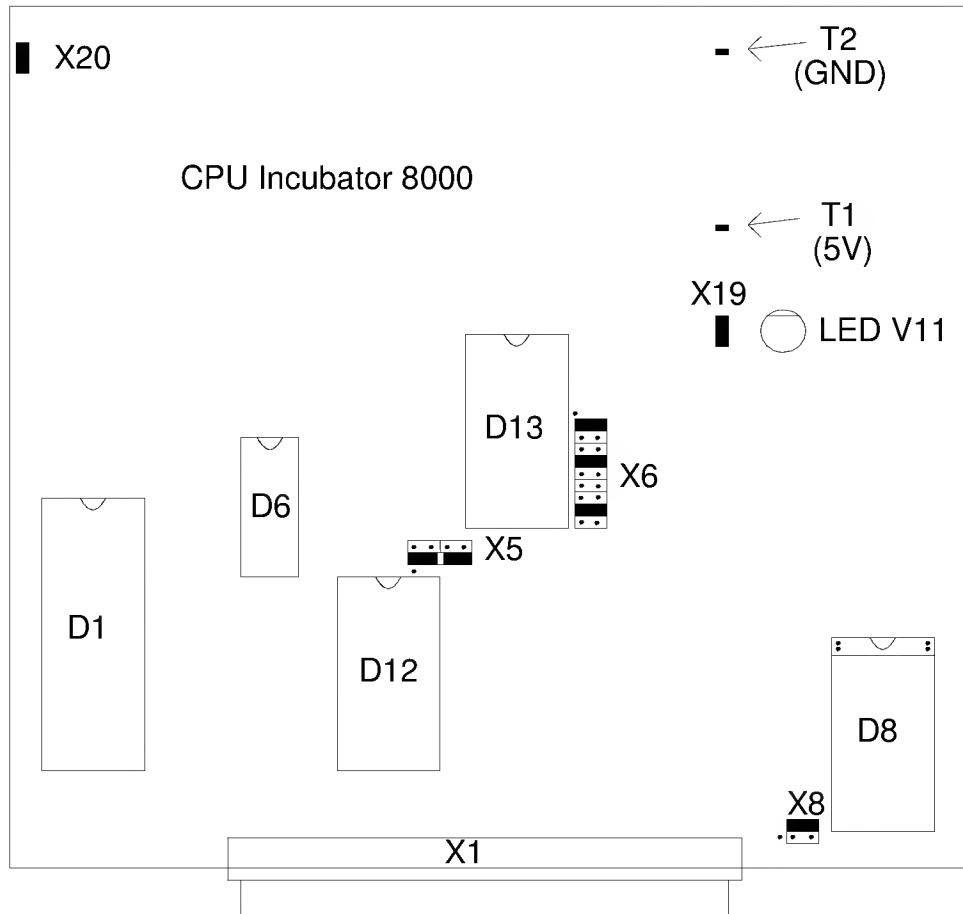
## Function of LED V11

LED	Cause	Remedy
off or glows slightly	normal condition	
off or glows slightly, but unit shows sporadic INOP-errors without storage of INOP error numbers	<ul style="list-style-type: none"><li>- +5V-supply defective (unstable)</li><li>- Voltage comparator incorrectly adjusted</li></ul>	<ul style="list-style-type: none"><li>- Test of +5V-voltage on the PCB CPU between T1 and T2: test value V = 4,8 to 5,2V</li><li>- Check voltage comparator on PCB CPU</li></ul>
LED lights up, device indicates INOP	<ul style="list-style-type: none"><li>- Watchdog-error</li><li>- Voltage comparator incorrectly adjusted</li><li>- +5V-supply too low</li></ul>	<ul style="list-style-type: none"><li>- Replace PCB CPU</li><li>- Check voltage comparator on PCB CPU</li><li>- Check of +5V-voltage on PCB CPU between T1 and T2, Test value V = 4,8 to 5,2V</li></ul>

### 8.2.5.3 PCB CPU Incubator 8000 (82 90 571)

**Note:** The PCB CPU Incubator 82 90 571 with the modification status "00" is being replaced by a modification status " $\geq 01$ ", see IDM no. 15 or TSB no. 12.

Layout plan:



Configuration of jumper fields with jumper 18 14 608:

Position	Software 1.xx, 1x.xx or 2x.xx
X5	1-2, 3-4 (like drawing)
X6	1-18, 4-15, 8-11 (like drawing)
X8	3-4 (like drawing)
X19	1-2 (like drawing)
X20	1-2 (like drawing)

Component configuration:

<b>Component and Position</b>	<b>Software 1.xx, 1x.xx, 2x.xx</b>
D1	Microprocessor 18 09 156
D6	Address decoder 83 04 920
D8	Time-Keeper-RAM 18 28 142 (Pin 1 of component in Pin 3 of base)
D12	EPROM, see 8.2.5.6
D13	Timer 18 13 900
B1 (not shown)	Battery not provided, SW 0.4 not possible

**Calibration:**

Not required.

Function of LED V11:

<b>LED</b>	<b>Cause</b>	<b>Remedy</b>
LED off or glows slightly	normal condition	
LED lights up, incubator switches to INOP immediately after switch-on	- Power-On-Reset on PCB CPU (N22) defective - Jumper X19 missing	- Replace PCB CPU - Check jumper
LED lights up, Incubator O.K.	- Voltage comparator N22 defective	- Replace PCB CPU

#### **8.2.5.4      Test**

The test is performed by the operation software, the errors are listed in the error list, if technically possible and can be read out.

The following error description indicates a CPU error:

- Device goes to INOP immediately after switch-on. In this case first of all check all operating voltages, please refer to 6, troubleshooting.
- LED on the PCB CPU lights up, see function of LED in 8.2.5.2 and 8.2.5.3.

#### **8.2.5.5      Exchange of PCB CPU in case of repair**

**Note:** The PCB CPU Incubator 82 90 571 with the modification status "00" is being replaced by a modification status " $\geq 01$ ", see IDM no. 15 or [TSB no. 12](#).

##### **PCB CPU Standard 2 (less useful)**

The following components are required for repair:

-	PCB CPU Standard 2	83 05 141
-	Timer	18 13 900
-	RAM (only for SW 0.4)	18 17 426
-	Time-Keeper-RAM (for SW 1.xx, 1x.xx or 2x.xx)	18 28 142
-	Address-Decoder	83 04 920
-	Jumper (to be taken from the defective PCB CPU)	18 14 508
-	EPROM	see 8.2.5.6 or spare parts list

Note: With SW version 1.xx, 1x.xx or 2x.xx battery B1 must be unsoldered.

## PCB CPU Incubator (useful)

The following components are required for exchange:

-	PCB CPU Incubator	82 90 571
-	Time-Keeper-RAM	18 28 142
-	EPROM	see 8.2.5.6 or spare parts list
-	Jumper	18 14 508
(are to be taken from defective PCB CPU)		

**Note:** The PCB CPU Incubator 82 90 571 with the modification status "00" is being replaced by a modification status " $\geq 01$ ", see IDM no. 15 or TSB no. 12.

## 8.2.5.6 Repair information software

**Important:** When performing repairs, software version is not to be upgraded from 10.nn to 11.nn or from 20.nn to 21.nn. **Exception:** Retrofitting with ThermoMonitoring set. These units have different operating instructions. Please note: SW 11.n is not available for US versions!

Comparison of new software versions 11.nn (SC/NC) and 21.nn (IC) with old software versions 10.nn and 20.nn

Incubator 8000 IC with skin-temperature measurement		
Assembly	SW 21.nn (new)	SW 20.nn (old)
Analog PCB	Order no. 82 90 680 Connection of 1 or 2 skin-temperature sensors is by way of wiring harness on left of basic housing. Recognition of 1 or 2 sensors is via the wiring harness which has its own connector separate from the other sensor connections. Range: 30 to 42 °C	Order no. 82 00 920 Connection of skin-temperature sensor on IC is to climate sensor. Range: 33 to 38 °C.
Climate sensor	2M 21 688 without skin temperature connection	82 90 380 with skin temperature connection
Keyboard	New keyboard 2M 21 681 with additional key for readout of second skin-temperature channel. If key is	Use can be made of either the old or the new keyboard

	not needed due to absence of thermomonitoring option, the key position is covered with a strip.	
Skin display PCB	New skin display PCB 82 90 691 with LED at different position for additional key required for readout of optional second skin-temperature channel.	Use can be made of old or new Display PCB

#### Incubator 8000 IC without skin-temperature measurement

Assembly	SW 21.nn (new)	SW 20.nn (old)
Climate sensor	2M 21 688 without skin temperature connection	82 90 380 with skin temperature connection

#### Incubator 8000 SC/NC with skin-temperature measurement

Assembly	SW 11.nn (new)	SW 10.nn (old)
Analog PCB	Order no. 82 90 680 Connection of 1 or 2 skin-temperature sensors is by way of wiring harness on left of basic housing. Recognition of 1 or 2 sensors is via the wiring harness.	Order no. 82 00 920 Skin-temperature sensor is connected on back of unit. Range: 33 to 38 °C.
Keyboard	New keyboard 2M 21 691 with additional key for readout of second skin-temperature channel. If key is not needed due to absence of ThermoMonitoring option, key position is covered with a strip. Additional feature: Alarm LED (central alarm).	Use can be made of either the old or the new keyboard. An alarm LED (central alarm) is not actuated even if it is fitted.
Skin display PCB	New skin display PCB 82 90 691 with LED at different position for additional key needed for readout of optional second skin-temperature channel.	Use can be made of old or new Display PCB.

**Incubator 8000 SC/NC without skin-temperature measurement**

No fundamental changes in terms of function between SW 10.nn and 11.nn, however different operating instructions.

Assembly	SW 11.nn (new)	SW 10.nn (old)
Keyboard	with central alarm	no central alarm

The following software versions apply to the units:

**Incubator 8000 IC with software 20.nn:**

- SW 20.00 allowed, but no longer available  
Is replaced by SW 20.01 (errors must be identified three times consecutively to lead to an Err- or INOP error). Principle exchange is not intended, but useful should errors occur sporadically.

- SW 20.01 allowed, but no longer available
- SW 20.02 allowed, but no longer available

Are replaced by SW 20.03: Service mode "A" has been included (voltage A/D test channel), skin-temp. mode up to 39 °C (previously 37 °C), additional alarm delay of 90 s for O2-measurement after swiveling climate sensor in, 2nd skin temp. channel provided by software (hardware is being prepared).

- SW 20.03 allowed, but no longer available
- SW 20.04 2M 22 327

**Incubator 8000 SC/NC with SW 10.nn:**

- SW 10.00 not released
- SW 10.01 / 10.02 allowed, but no longer available

Are replaced by SW 10.03 (errors must be identified three times consecutively to lead to an Err- or INOP error). A principle exchange is not intended, but useful should errors occur sporadically.

- SW 10.03 allowed, but no longer available

Is replaced by SW 10.04: Service mode "A" has been included (voltage A/D test channel), skin-temp. mode up to 39 °C air temperature (previously 37 °C).

- SW 10.04 allowed, but no longer available
- SW 10.05 2M 22 326

Incubator 8000 IC with software 21.nn:

- SW 21.02 2M 22 331

**Incubator 8000 SC/NC with SW 11.nn (not available for US versions):**

- SW 11.02 2M 22 332

## 8.2.5.7 Repair information and modification states

### 1. New PCB CPU Incubator 01.93

From the beginning of 1993 all Incubators 8000 SC/IC/NC will include the new PCB CPU Incubator 83 05 141. This PCB CPU replaces the current PCB CPU Standard 2. In case of repair both versions can be used, since the PCB CPU Incubator is a simplified version of PCB CPU Standard on which unused components are not fitted. Also refer to 8.2.5.5 "Exchange of PCB CPU in case of repair".

**Note:** The PCB CPU Incubator 82 90 571 with the modification status "00" is being replaced by a modification status " $\geq 01$ ", see IDM no. 15 or [TSB no. 12](#).

## 8.2.6 PCB Analog with PCB Filter

### 8.2.6.0 Table of Contents

- 8.2.6.1 Information about PCBs used
- 8.2.6.2 PCB Analog 82 00 770 / 82 00 920 with PCB Filter 83 02 526  
(layout up to mid 95)
- 8.2.6.3 PCB Analog 82 00 770 / 82 90 920 / 82 90 680  
(layout as of mid 95)
- 8.2.6.4 Test and Calibration PCB Analog 82 00 770 / 82 00 920 / 82 90 680
- 8.2.6.5 N/A
- 8.2.6.6 Exchange of PCB Analog in case of repair
- 8.2.6.7 Repair information and change status

### 8.2.6.1 Information about PCBs used

3 different PCBs are currently in use in Incubator 8000 and 8000 SC/IC/NC.

#### Incubators without skin temperature control:

- PCB Analog 82 00 770

Note: partly fitted PCB Analog 82 00 920 without skin temperature amplifier.

#### Incubators with skin temperature control:

- PCB Analog 82 00 920

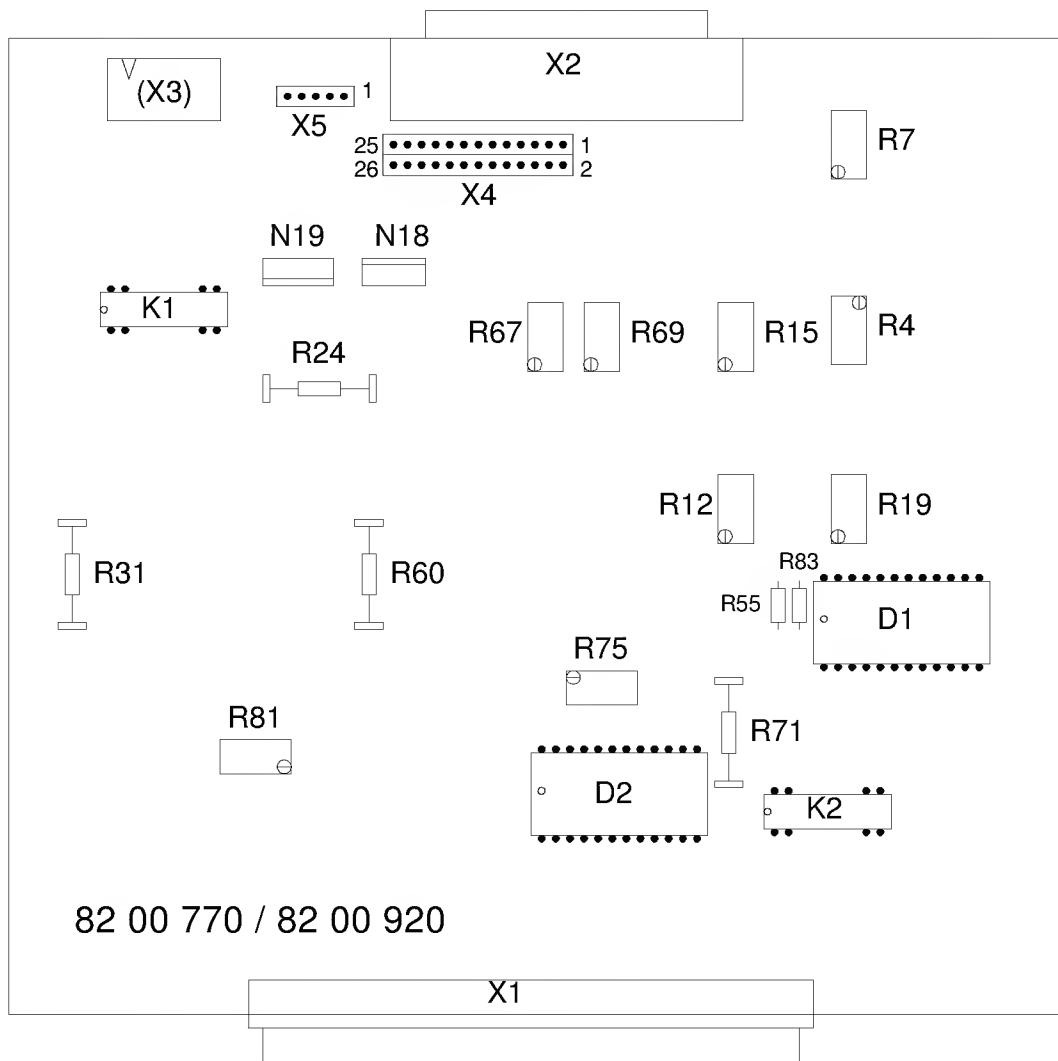
Note: Until end of 1992 the units including PCB Analog 82 00 920 were equipped with a PCB Filter Circuit 83 02 526. During repair this PCB Filter Circuit may be removed and replaced by two jumpers on the PCB Analog 82 00 920, please refer to 8.2.6.2.

Only for SW 11.nn or 21.nn:

- PCB Analog 82 90 680

### 8.2.6.2 PCB Analog 82 00 770 / 82 00 920 with PCB Filter 83 02 526 (layout up to mid 95)

Layout: (the figure below shows PCB Analog 82 00 920 fully equipped):



Configuration:

<b>Position</b>	<b>Component or function</b>	
X1	Connection to PCB Motherboard	
X2	Connection to climatic sensor (Inc. 8000 and Inc. 8000 IC) or to air temperature sensor (Inc. 8000 SC/NC)	
X3	not used	
X4	26 test points	
X5	Connection to PCB Filter Circuit with PCB Analog 82 00 920. If no PCB Filter Circuit is installed, jumpers from X5/1 to X5/4 and from X5/2 to X5/5 must be soldered on the back.	
D1	Multiplexer	18 23 345
D2	A/D-converter	18 23 256
K1, K2 (K1 not with 82 00 770)	Relay	18 13 714
N18	Voltage controller +5 V	18 21 458
N19	Voltage controller -5 V	18 23 337
Potentiometer R4	Calibration of air temperature amplifier	
Potentiometer R7	Calibration of air temperature amplifier	
Potentiometer R12	Calibration of overtemperature amplifier	
Potentiometer R15	Calibration of overtemperature amplifier	
Potentiometer R19	Calibration of overtemperature comparator 40 °C	
R24	Calibration of skin temperature amplifier	
R31	Calibration of skin temperature amplifier	
R60	no function	
Potentiometer R67	no function	
Potentiometer R69	no function	
R71	Calibration of A/D converter	
Potentiometer R75	Calibration of A/D converter	
Potentiometer R81	no function	
R55 / R83	Voltage divider A/D test channel	

**Calibration:**

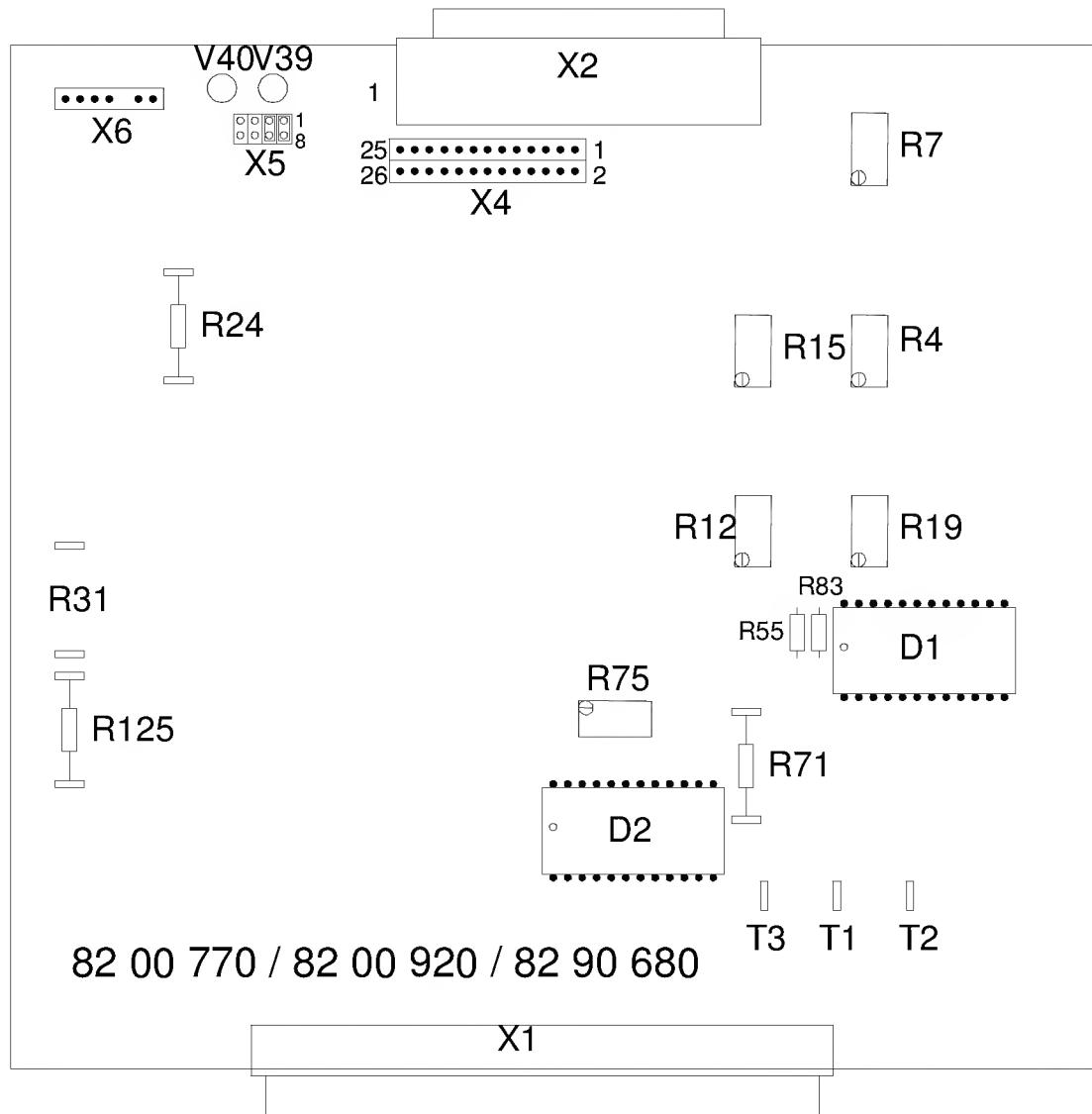
see 8.2.6.4

**Repair information:****1 . Repair information error 19 and 65**

Whenever the PCB Analog 82 00 770 / 82 00 920 or the voltage regulator for + 15 V or - 15 V or the PCB Power Pack 82 90 461 is replaced the A/D test channel must be checked and calibrated, if necessary, please refer to 8.2.6.4.

### 8.2.6.3 PCB Analog 82 00 770 / 82 90 920 / 82 90 680 (layout as of mid 95)

Layout: (the figure below shows PCB Analog 82 00 920 / 82 90 680 fully equipped):



### Important:

- LED V40 lights if - 5 V for AD converter is available. This voltage is stepped down from the - 15 V.
- LED V39 lights if + 5 V for AD converter is available. This voltage is stepped down from the + 15 V.

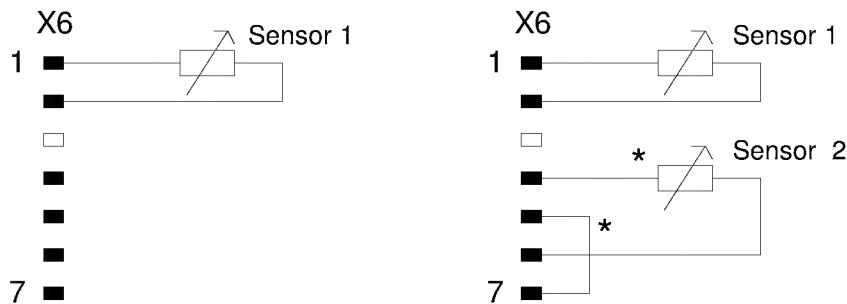
Calibration: see 8.2.6.4

### Important: Repair information, errors 19 and 65

On replacing PCB Analog 82 00 770 / 82 00 920 / 82 90 680 or voltage regulator for + 15 V or - 15 V or PCB Power Pack 82 90 461 A/D test channel must always be checked and if necessary calibrated, see 8.2.6.4.

Wiring harness, skin temperature (82 90 680 only):

This is the side connection for skin-temperature sensors with cable link to PCB Analog 82 90 680. Important: With this PCB, skin-temperature sensor(s) is/are attached to connector X6.



1 skin-temperature connection:

- Wiring harness, complete (with socket) 2M 21 738

2 skin-temperature connections:

- Wiring harness, complete (with socket) 2M 21 738

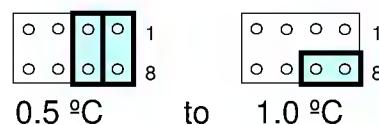
extended with

- (\*) Thermomonitoring option (with 2nd socket) 2M 21 733  
(incl. ThermoView PC program 2M 21 888)

**Important:** All US versions Incubator 8000 IC with ThermoMonitoring for the USA and Canada will be delivered with a skin temperature deviation alarm limit of 1.0 °C according the US version of the Operating Instructions of the Incubator 8000 IC Software Version 21.n.

For this change the following modification is necessary:

1. Place a sticker "  $\pm 1$  °C " with the order no. 2M 21 921 on the keypad of the skin temperature control module directly over the "  $\pm 0.5$  °C " label.
2. Change the jumper configuration X5 on the Analog PCB 82 90 680 from:



## 8.2.6.4 Test and Calibration of PCB Analog

### Table of Contents:

- a Test equipment required
- b Test of operating voltages
- c Calibration of A/D test channel
- d Calibration of air temperature amplifier
- e Calibration of excess-temperature amplifier and excess-temperature comparator
- f Calibration of skin temperature amplifier
- g Test of O<sub>2</sub>-inputs and O<sub>2</sub> comparators
- h Calibration of A/D converter

#### **a Test equipment required**

- Multimeter 79 01 021
- Measuring adapter Incubator 8000 79 01 471 or
- Testboard uni 40 79 00 610
- Sensor simulator Incubator 8000 (for d, e , g, and e) 79 01 240
- Skin temperature sensor simulator (for f) 79 01 236
- 2 decade resistors (for f and e) 79 01 146

## b Test of operating voltages

Unit is open, but ready for operation. Switch on Incubator. To facilitate measurement the measuring adapter 79 01 471 can be connected to terminal strip X4.

Measurement of voltages at terminal strip X4:

TP 25 (+ 5 V, of PCB Power Pack)  $\Rightarrow$  TP 26 (GNDD):  $V = + 5,0 \pm 0,2 \text{ V}$

TP 18 (+ 15 V, of PCB Power Pack)  $\Rightarrow$  TP 26 (GNDD):  $V = + 15,0 \text{ V} \pm 0,6 \text{ V}$

TP 22 (- 15 V, of PCB Power Pack)  $\Rightarrow$  TP 26 (GNDD):  $V = - 15,0 \text{ V} \pm 0,6 \text{ V}$

TP 20 (+ 5 V, generated on PCB Analog)  $\Rightarrow$  TP 21 (GNDA):  $V = + 5,0 \text{ V} \pm 0,4 \text{ V}$

TP 24 (- 5 V, generated on PCB Analog)  $\Rightarrow$  TP 21 (GNDA):  $V = - 5,0 \text{ V} \pm 0,4 \text{ V}$

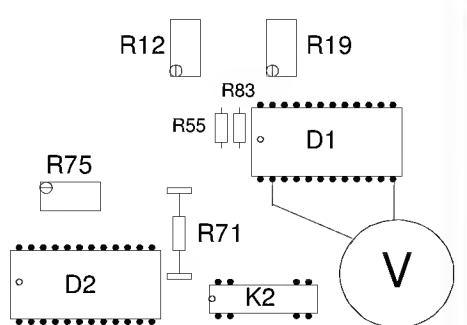
## c Calibration of A/D test channel

Important: As of SW 10.04 (Inc. 8000 SC/NC) and SW 20.03 (Inc. 8000 IC) it is possible to read out this voltage directly in mV in service mode "A", see 6.2.2.11.

Unit is open, but ready for operation. Switch on unit and wait for self-test.

Read out voltage of A/D test channel:

- In service mode "A"
- or
- Measure the A/D test channel voltage at the multiplexer D1 between Pin 2 (test voltage) and Pin 12 (GNDA) using a quick multimeter (79 01 021, Soar or BBC).



Measurement is performed after the self-test (approx. 35 seconds), but the device must not be in INOP condition. In the event of an INOP error 65 or 19 follow the calibration instructions.

Test value: The A/D test channel test voltage is the lower voltage with the multiplexer switched through.

$$V = 4.4 \pm 0.3 \text{ V}$$

Calibration instructions:

In the event of deviations from the test value the voltage divider R55 / R83 must be modified:

Important: The new layout as of approx. mid 95 features soldering terminals for calibration of the AD converter test voltage:

T1 (AD test) and T2 (+15 V) are in parallel with R55

T1 (AD test) and T3 (-15 V) are in parallel with R83

- Voltage too low or error 65:

Increase voltage by means of additional resistor in series with R83 and repeat test, recommendation: approx. 2kohm.

- Voltage too high or error 19:

Reduce voltage by means of additional resistor in series with R55 and repeat test, recommendation approx. 1kohm.

## **d Calibration of air temperature amplifier**

- Connect sensor simulator Incubator 8000 (79 01 240) to X2.
- The sensor simulator must have the following basic setting:
  - o Temperature = 35 °C
  - o Humidity = 70 %
  - o Sensor = 1
- Switch on incubator and wait for 35 second self-test.
- Measure voltage between X4/3 and X4/21 (GNDA)
- Set voltage to  $V = 625 \text{ mV} \pm 0.5 \text{ mV}$  using potentiometer R7
- Measure voltage between X4/4 and X4/21 (GNDA)

- Use potentiometer R4 to set the voltage to  $V = 2,917 \text{ V} \pm 0,005 \text{ V}$
- Indication on actual value display air temperature =  $35,0 \text{ }^{\circ}\text{C} \pm 0,1 \text{ }^{\circ}\text{C}$
- Set sensor simulator to  $25,0 \text{ }^{\circ}\text{C}$
- Indication on actual value display air temperature =  $25,0 \text{ }^{\circ}\text{C} \pm 0,2 \text{ }^{\circ}\text{C}$
- Set sensor simulator to  $45,0 \text{ }^{\circ}\text{C}$
- Indication on actual value display air temperature =  $45,0 \text{ }^{\circ}\text{C} \pm 0,2 \text{ }^{\circ}\text{C}$

**e Calibration of excess temperature amplifier and excess temperature comparator**

- Connect sensor simulator Incubator 8000 (79 01 240) to X2
- The sensor simulator must have the following basic setting:
  - o Temperature =  $35 \text{ }^{\circ}\text{C}$
  - o Humidity =  $70 \text{ \%}$
  - o Sensor = 1
- Switch incubator on and wait for 35 seconds self-test
- Call up service mode 5, please refer to 6.3 service mode
- Measure voltage between X4/6 and X4/ 21 (GNDA)
- Use potentiometer R15 to set the voltage to  $625 \text{ mV} \pm 0,5 \text{ mV}$
- Measure voltage between X4/8 and X4/21 (GNDA)
- Use potentiometer R12 to set the voltage to  $3,500 \text{ V} \pm 0,005 \text{ V}$
- Indication on actual value display air temperature =  $35,0 \text{ }^{\circ}\text{C} \pm 0,1 \text{ }^{\circ}\text{C}$
- Set sensor simulator to  $25 \text{ }^{\circ}\text{C}$
- Indication on actual value display air temperature =  $25,0 \pm 0,2 \text{ }^{\circ}\text{C}$
- Set sensor simulator to  $45 \text{ }^{\circ}\text{C}$
- Indication on actual value display air temperature =  $45,0 \text{ }^{\circ}\text{C} \pm 0,2 \text{ }^{\circ}\text{C}$

- Set sensor simulator to 40 °C
- Measure voltage between X4/7 and X4/21 (GNDA)
- Use potentiometer R19 to set the voltage such that it changes from negative value to positive value
- Set sensor simulator to 39,7 °C (or 39,5 °C)
- Negative voltage (- 12 V to - 15,6 V)
- Set sensor simulator to 40,2 °C (or 40,5 °C)
- Positive voltage (+ 12 V to + 15,6 V)

## **f Calibration of skin temperature amplifier**

- Connect sensor simulator Incubator 8000 (79 01 240) to X2
- Connect skin temperature sensor simulator (79 01 236) to sensor simulator Incubator 8000

The sensor simulator Incubator 8000 must have the following basic setting:

- o Temperature = 35 °C
- o Humidity = 70 %
- o Sensor = 1

The skin temperature sensor simulator must have the following basic setting:

- o Temperature = 36.0 °C
- o Sensor connected/not connected (82 90 680 only)

- Only for 82 90 680:  
Connect pin X1/29c to GND. GND is e.g. X1/32a or X1/32b.
- Switch incubator on and wait for 35 second self-test
- Measure voltage between X4/17 and X4/21 (GNDA)
- Connect a decade resistor (initial value for 82 00 920 approx. 40 K ohm, for 82 90 680 approx. 5 K ohm) to the soldering tags of R24 and adjust such that the voltage is:  
308.6 mV ± 0.5 mV for 82 00 920 or  
385.5 mV ± 0.5 mV for 82 90 680

- Solder the set resistance value to exactly 10 Ohm to the soldering tags of R24 (if applicable, 2 resistors connected in series or in parallel)
- Check calibration
- Measure voltage between X4/11 and X4/21 (GNDA)
- Connect a decade resistor (initial value for 82 00 920 approx. 5 K ohm, for 82 90 680 approx. 150 K ohm) to the soldering tags of R31 (82 00 920) or R125 (82 90 680) and adjust such that the voltage is:  
2.857 V  $\pm$  0.010 V for 82 00 920 or  
2.500 V  $\pm$  0.010 V for 82 90 680
- Solder the set resistance value to exactly 10 Ohm to the soldering tags of R31 (if applicable, 2 resistors connected in series or in parallel)
- Check calibration
- Indication on actual value display skin temperature. = 36,0 °C  $\pm$  0,1 °C
- Set skin temperature sensor simulator to 33,2 °C
- Indication on actual value display skin temperature = 33,2 °C  $\pm$  0,2 °C
- Set skin temperature sensor simulator to 37,8 °C
- Indication on actual value display skin temperature = 37,8 °C  $\pm$  0,2 °C
- Press key "Check 36,0 °C" in skin temperature module
- Indication on actual value display air temperature = 36,0 °C  $\pm$  0,1 °C
- Only for 82 90 680:  
Remove connection between pin X1/29c and GND.

## **g Test of O<sub>2</sub> inputs and O<sub>2</sub> comparators**

- Connect sensor simulator Incubator 8000 (79 01 240) to X2
- The sensor simulator must have the following basic setting:
  - o Temperature = 35 °C
  - o Humidity = 70 %

o Sensor = 1

- Switch on incubator and wait for 35 second self-test
- A potential excess-temperature warning can be switched off by pressing the "Reset Excess-temperature" key
- Set O2-voltages at sensor simulator to  $50 \text{ mV} \pm 1 \text{ mV}$  each using the two potentiometers. The voltages can be measured at the sensor simulator below the potentiometers.
- Measure voltage between X4/1 and X4/21 (GNDA),  
Test value =  $1,97 \text{ V} \pm 0,05 \text{ V}$
- Measure voltage between X4/5 and X4/21 (GNDA),  
Test value =  $0,72 \text{ V} \pm 0,02 \text{ V}$
- Set both O2-voltages at sensor simulator to  $10 \text{ mV} \pm 0,5 \text{ mV}$
- Measure voltage between X4/12 and X4/21 (GNDA),  
Test value  $\leq 0,1 \text{ V}$
- Reduce O2-voltage A to 1 mV
- Test value  $\geq 11 \text{ V}$
- Set O2-voltage A to  $10 \text{ mV} \pm 0,5 \text{ mV}$
- Test value  $\leq 0,1 \text{ V}$
- Set O2-voltage B to 1 mV
- Test value  $\geq 11 \text{ V}$
- Set O2-voltage B to  $10 \text{ mV} \pm 0,5 \text{ mV}$
- Test value  $\leq 0,1 \text{ V}$

## **h Calibration of A/D-converter**

- Connect sensor simulator Incubator 8000 (79 01 240) to X2
- The sensor simulator must have the following basic setting:

o Temperature = R ext.  
o Humidity = 70 %  
o Sensor = 1

- Connect a decade resistor for "R ext. Excess-temperature" at the sensor simulator.
- Switch incubator on and wait for 35 second self-test.
- Call service mode 5, please refer to 6.3 Service-Mode
- Measure voltage between X4/8 and X4/21 (GNDA)
- Set the voltage to 0 mV + 1 mV by means of the decade resistor.
- Use potentiometer R75 to set the zero point of the A/D-converter such that the actual value display just changes from 0,0 °C to 0,1 °C
- Set voltage to 5,000 V ± 0,001 V by means of the decade resistor.
- Connect another decade resistor to the soldering tags of R71 and adjust such that the actual value display just changes from 49,9 °C to 50,0 °C.
- Solder the set resistance to soldering tags of R71 (if applicable, 2 resistors connected in series or parallel)

Check calibration at:

o 5,00 V = 50,0 °C ± 0,1 °C  
o 4,00 V = 40,0 °C ± 0,1 °C  
o 3,00 V = 30,0 °C ± 0,1 °C  
o 2,00 V = 20,0 °C ± 0,1 °C  
o 0,00 V = 0,0 °C ± 0,1 °C

### 8.2.6.5 N/A

## 8.2.6.6 Exchange of PCB Analog in case of repair

Important: When replacing PCB Analog, A/D test channel must be checked and if necessary calibrated, see 8.2.6.4.

Important: In the case of PCBs with the new layout, the PCB Filter for the skin-temperature sensor cannot be connected and is also not necessary.

In case of repair the following spare parts may be used:

### Incubators with skin temperature control:

- Only for SW 10.nn / 20.nn:
  - PCB Analog 82 00 920
- Only for SW 11.nn / 21.nn:
  - PCB Analog 82 90 680

Note: If there is no filter circuit, two jumpers must be soldered onto the PCB Analog with layout up to 06.95, please refer to the configuration X5 under 8.2.6.1.

### Incubators without skin temperature control:

- PCB Analog 82 00 770

## 8.2.6.7 Repair information and change status

1. Exchange of PCB Analog and Repair Information 3.93  
INOP error 19 and 65

Whenever the PCB Analog 82 00 770 / 82 00 920 or the voltage controller for + 15 V or - 15 V or the PCB Power Pack 82 90 461 is exchanged the A/D test channel must be checked and be calibrated, if necessary, please refer to 8.2.6.4.

<b>2. PCB Analog 82 00 920 (incl. skin temperature) without PCB filter circuit</b>	<b>4.93</b>
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As of now all incubator with skin temperature control are manufactured without PCB Filter Circuit. In case of repair this filter circuit may be dismounted from all units, for this solder jumpers from X5/1 to X5/4 and from X5/2 to X5/5 on the soldering side of the PCB Analog.

<b>3. New PCB Analog 82 90 680, new layout for PCB Analog 82 00 770/82 00 920</b>	<b>4.93</b>
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These PCBs have been revised (new layout without relays) and are available in 3 versions. Important: The order no. on the PCB describes the function. The new PCB Analog 82 90 680 has a larger measuring range for skin temperature than the PCB Analog 82 00 920 and only functions in conjunction with SW 11.nn or 21.nn.

Incubators without skin-temperature control:

° PCB Analog 82 00 770

Incubators with skin-temperature control:

° Only for 10.nn/20.nn:

PCB Analog 82 00 920

° Only for SW 11.nn or 21.nn:

PCB Analog 82 90 680

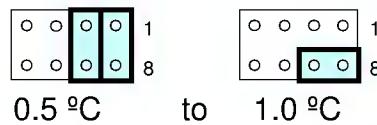
Important: The filter circuit can no longer be connected to the PCB Analog 82 00 720/82 90 680 with the new layout. When performing repairs, the filter circuit is to be removed.

**4. Change of skin temperature deviation alarm from 0.5 to 1.0 °C for all US versions Incubator 8000 IC with ThermoMonitoring,**

Reason: All US versions Incubator 8000 IC with ThermoMonitoring for the USA and Canada will be delivered with a skin temperature deviation alarm limit of 1.0 °C according the US version of the Operating Instructions of the Incubator 8000 IC Software Version 21.n.

Solution: For this change the following modification is necessary:

1. Place a sticker "  $\pm 1$  °C " with the order no. 2M 21 921 on the keypad of the skin temperature control module directly over the "  $\pm 0.5$  °C " label.
2. Change the jumper configuration X5 on the Analog PCB 82 90 680 from:



Devices affected: All Incubators 8000 IC as of software version 21.n in the USA and Canada.

Additional info: Please order the sticker 2M 21 921 "  $\pm 1$  °C " always in addition to the spare parts keypad or electronics module.

## **8.2.7 PCB Power Pack**

### **8.2.7.0 Table of Contents**

- 8.2.7.1 Information about Printed Circuit Boards used
- 8.2.7.2 N/A
- 8.2.7.3 PCB Power Pack 82 90 461 (for Inc. 8000 SC/IC/NC)
- 8.2.7.4 Testing
- 8.2.7.5 Replacement in the event of Repair
- 8.2.7.6 Repair Information and Change Status

### **8.2.7.1 Information about Printed Circuit Boards**

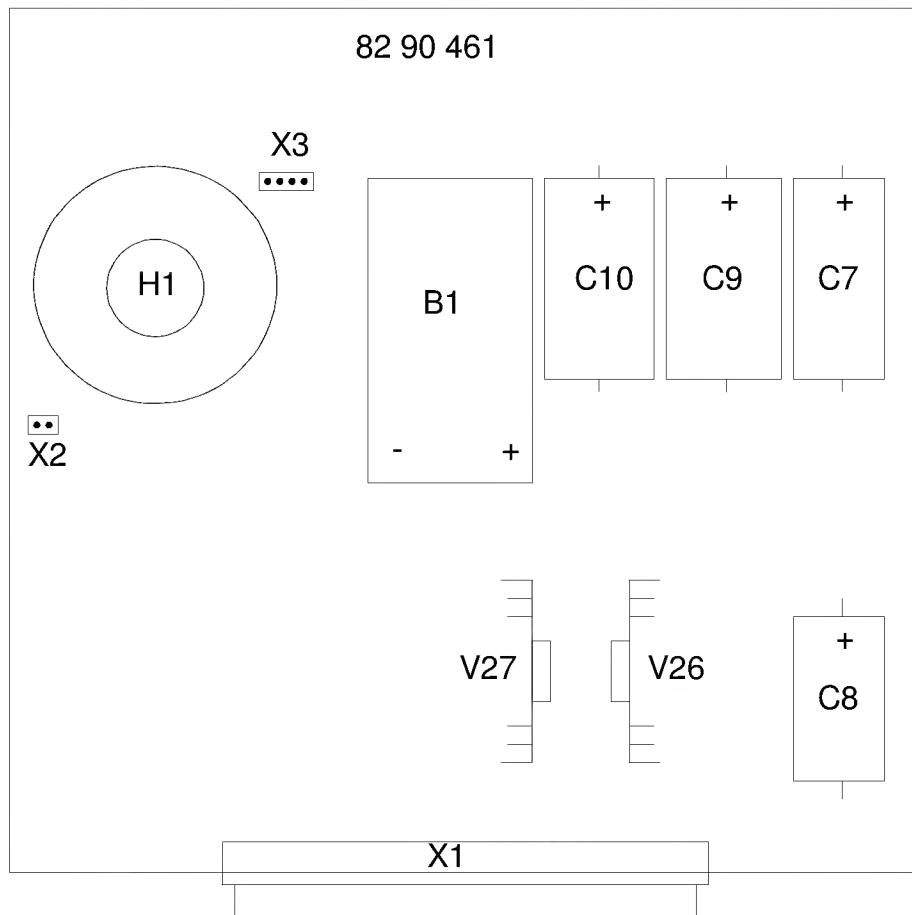
#### **PCB Power pack 82 90 461 (for Inc. 8000 SC/IC/NC)**

With this PCB Power Pack 82 90 461 only the voltage regulator for + 5 V is located on the side plate of the electronics module. This PCB Power Pack functions only with the PCB Motherboard 82 90 471 for Inc. 8000 SC/IC/NC.

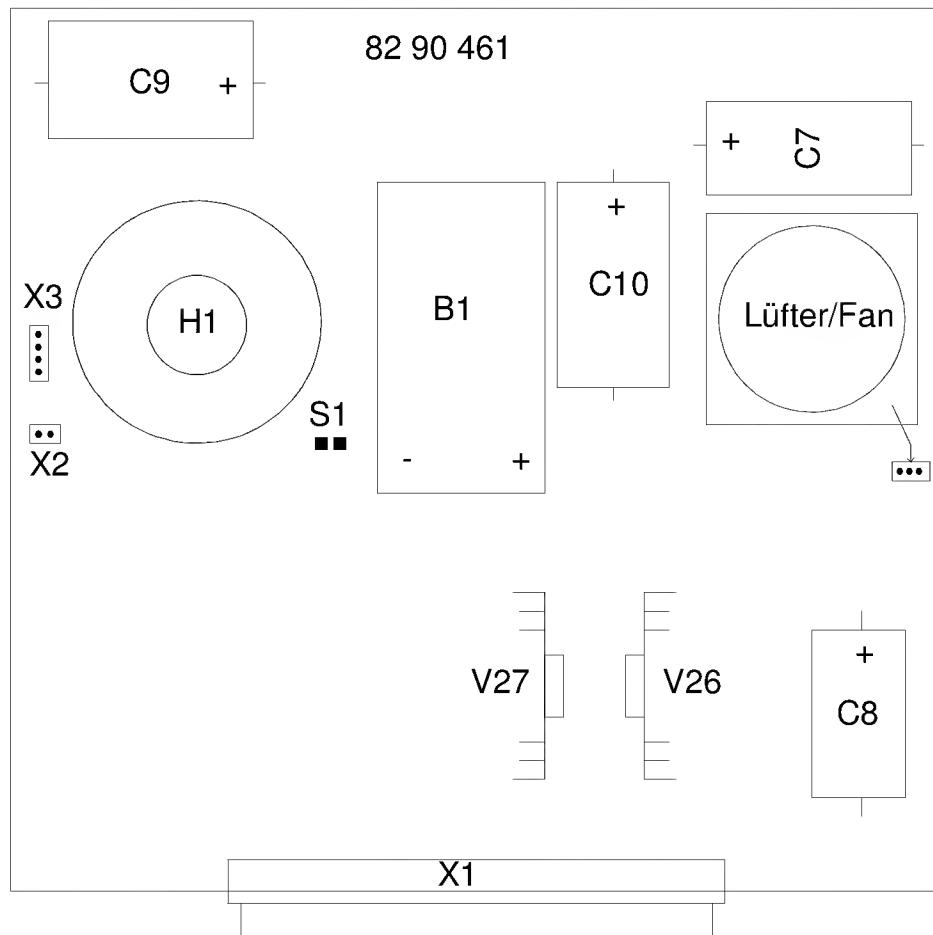
#### **8.2.7.2 N/A**

### 8.2.7.3 PCB Power pack 82 90 461 (of Inc. 8000 SC/IC/NC)

Layout PCB Power Pack 82 90 461 without fan:



Layout PCB Power Pack 82 90 461 with fan available as of 1993:

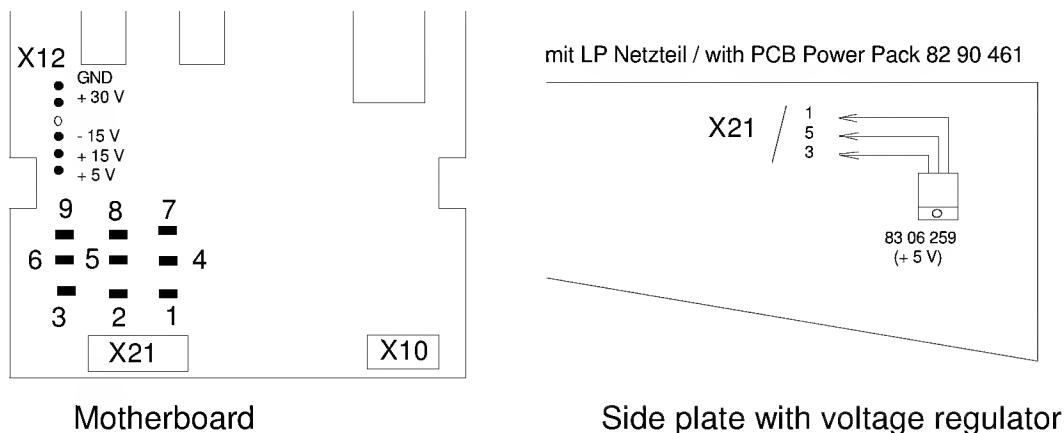


Configuration:

Position	Component or Function
X1	Connection to Motherboard
B1	Storage battery 83 01 856, to be renewed once a year
H1	Audible signal generator 83 01 708
V26	Voltage regulator + 15 V 18 21 466
V27	Voltage regulator - 15 V 18 21 423
Fan (as of approx. 1993)	Miniature fan 1.2 W 18 33 863
S1 (only on PCB 82 90 461 with fan)	must be kept closed during operation
X2	Jumper location for audible alarm silence, must <b>never</b> be short-circuited during operation!
X3	Test points for voltage supply + 5 V, + 15 V, GND and - 15 V

## Voltage regulator

The voltage regulators for + 15 V and - 15 V are located on the printed circuit board, the + 5 V -regulator 83 06 259 is located on the side plate of the electronics module, connected on the PCB Motherboard, refer also to 8.2.8.3:



Adjustment:

not required

### 8.2.7.4 Testing

The following functions are available on the PCB Power Pack:

- Rectification of the a.c. voltages and stabilization of the d.c. voltages
- Storage battery charge circuit
- Hooter and hooter control
- Control of powerfail LED
- Generation of powerfail signal
- Fan for cooling of electronics module on PCB Power Pack 82 90 461 as of 1993

#### Testing Supply Voltages:

- PCB Power Pack 82 90 461:

Measurement is carried out on the printed circuit board at test connector X3

X3/1      V = + 5 V +/- 0.2 V

X3/2      GND

X3/3      V = + 15 V +/- 0.6 V

X3/4      V = - 15 V +/- 0.6 V

Note: For testing of the a.c. voltage supply 8.1.8.3

### **Testing Storage Battery Charge Circuit**

Remove storage battery and measure current between connections of storage battery mount:

Printed circuit board without fan: Current = 9 to 19 mA

Printed circuit board with fan:      Current = 0,6 to 1,3 mA

Mount storage battery.

### **Testing Powerfail Recognition, Control of Powerfail LED and Hooter in the event of Powerfail**

- Device is switched on and self-test is completed.
- Switch on all modules available.
- Disconnect Incubator from power supply.
- Testing: Hooter and powerfail LED on PCB Display Air Temperature on
- Connect device to power supply again.
- Testing: The device should continue working with all modules (as adjusted previously). If not, the time keeper RAM on PCB CPU might be defective.

### **Control of Hooter**

During operation press the button "Check lamps": hooter ON.

### **Fan (if fitted)**

The fan is no longer necessary, refer to service bulletin.

### 8.2.7.5 Exchange in case of repair

The following spare parts can be used in case of repair:

#### **Electronics module with PCB Motherboard 82 90 471 (of Inc. 8000 SC/IC/NC)**

-	PCB Power Pack	82 90 461
-	Voltage regulator + 15 V	18 21 466
-	Voltage regulator - 15 V	18 21 423
-	Voltage regulator + 5 V	83 06 259
-	Storage battery (must be renewed once a year)	83 01 856

**Note: Observe repair information and change status 8.2.7.6!**

### 8.2.7.6 Repair Information and Change Status

- 1. Replacement of PCB Power Pack 82 90 461 or voltage regulators for + 15 V or - 15 V** 3.93

When replacing the above mentioned components it is necessary to check the A/D test channel on the PCB Analog and to adjust it, if applicable, refer to 8.2.6.4.

- 2. PCB Power Pack 82 90461 with Fan or possibility for connect a Fan**

Prior to initial use of this printed circuit board close the soldering switch S1 otherwise the storage battery will not be charged.

**8.2.8      PCB Motherboard****8.2.8.0    Table of Contents**

8.2.8.1    N/A

8.2.8.2    N/A

8.2.8.3    PCB Motherboard 82 90 471 (of Inc. 8000 SC/IC/NC)

8.2.8.4    Testing

8.2.8.5    Exchange of PCB Motherboard in Case of Repair

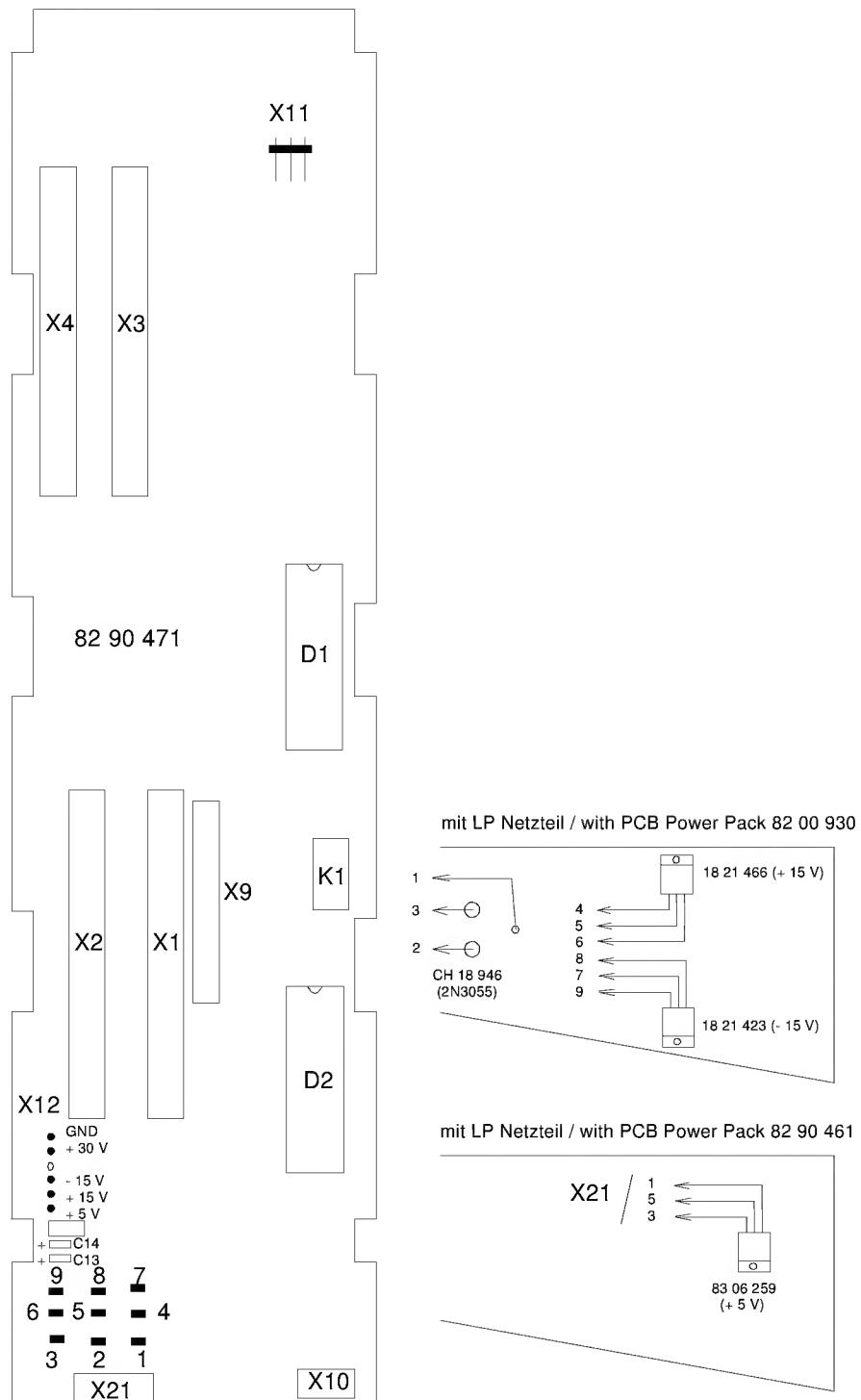
8.2.8.6    Repair information and Change Status

**8.2.8.1    N/A**

**8.2.8.2    N/A**

### 8.2.8.3 PCB Motherboard 82 90 471

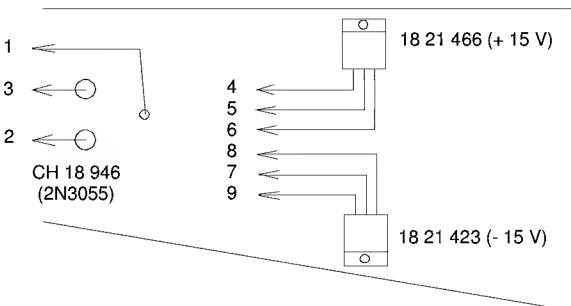
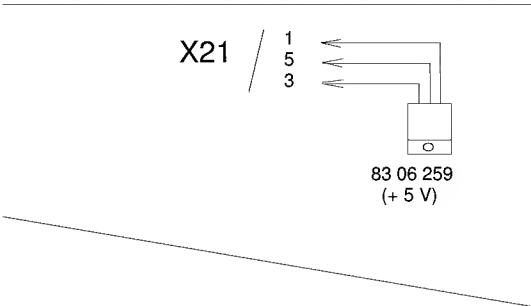
Layout:



The PCB Motherboard 82 90 471 functions in conjunction with the PCB Power Pack 82 90 461 (of Inc. 8000 SC/IC/NC, only the + 5V - voltage regulator on the side plate)

Configuration:

<b>Position</b>	<b>Component or Function</b>
X1	Connection to PCB Power Pack
X2	Connection to PCB Analog
X3	Connection to PCB CPU
X4	Connection to PCB Controller (RS232), optional for Inc. 8000 SC/IC
X9	Connection to Unit
X10	Connection to PCB Switch
X11	Connection to auxiliary fan 2M 20 021
X12	Test points for voltage supply: X12/1 = GND X12/2 = + 30 V (non-stabilized, load-dependent) X12/3 = not available X12/4 = - 15 V X12/5 = + 15 V X12,6 = + 5 V
X21 (not available on all printed circuit boards)	Connection voltage regulator + 5 V 83 06 259
D1, D2	PIA 6821 18 23 361
K1	Bipolar relay 18 12 653
C13 / C14	Capacitor 1 µF 18 01 309 (only necessary on PCB Power Pack 82 00 930 of Inc. 8000, not fitted ex works)

Position	Component or Function
<p>Solder tag 1 to 9</p> <p>mit LP Netzteil / with PCB Power Pack 82 00 930</p>  <p>mit LP Netzteil / with PCB Power Pack 82 90 461</p> 	<p><b>with PCB Power Pack 82 90 461 (or Inc. 8000 SC/IC), if X21 is not available:</b></p> <ul style="list-style-type: none"> <li>- Connection Voltage regulator + 5 V 83 06 259</li> <li>1 = white</li> <li>3 = red</li> <li>5 = blue</li> </ul>

#### Adjustment:

not required

#### 8.2.8.4 Testing

Testing of the PCB Motherboard is carried out by the system software. Exception: control of the auxiliary fan. The auxiliary fan is always switched on when the air heating is off.

#### 8.2.8.5 Exchange in Case of Repair

The following spare parts can be used in case of repair:

- PCB Motherboard 82 90 471

## 8.2.9 PCB Switch

The PCB Switch 82 00 880 comprises 3 switches:

S1.1      Switching on of the device via mains auxiliary transformer and the mains closing relay on the PCB Unit

S1.1 / S 1.2      Generation of powerfail alarm. During operation S1.3 is monitored via the PIA D2 on the PCB Motherboard (Fault 66)

## Possible faults:

Fault	possible cause
Device cannot be switched on	PCB Switch or PCB Unit defective, testing the Unit, refer to 8.1.8.3
no visual and audible powerfail alarm	<ul style="list-style-type: none"> <li>- Storage battery on PCB Power Pack discharged</li> <li>- PCB Switch defective</li> <li>- PCB Power Pack defective</li> <li>- LED on the PCB Display Air Temperature defective (only if audible powerfail alarm is available)</li> <li>- Soldering switch S1 on PCB Power Pack 82 90 461 "with Fan" open, refer to 8.2.7.3</li> </ul>
Failure 66	<ul style="list-style-type: none"> <li>- PCB Switch defective</li> <li>- PIA D2 on the PCB Motherboard defective</li> </ul>

### **Exchange in case of repair:**

- PCB Switch 82 00 880

### Repair information and change status:

no entries

8.2.10 N/A

## **8.2.11 PCB Controller (RS232) 82 90 581**

### **8.2.11.0 Contents**

- 8.2.11.1 Use
- 8.2.11.2 Layout plan, configuration and test points
- 8.2.11.3 Function test
- 8.2.11.4 Exchange in case of repair
- 8.2.11.5 Repairinformation Software
- 8.2.11.6 Retrofitting
- 8.2.11.7 Repair information and modification states

### **8.2.11.1 Use**

The PCB Controller is a communication board with Medibus log via a RS232 interface and is only intended for Incubator 8000 SC/IC/NC. The PCB Controller monitors the incubator bus, the data read in is processed and made available to the interface. The interface is electrically isolated from the incubator electronics.

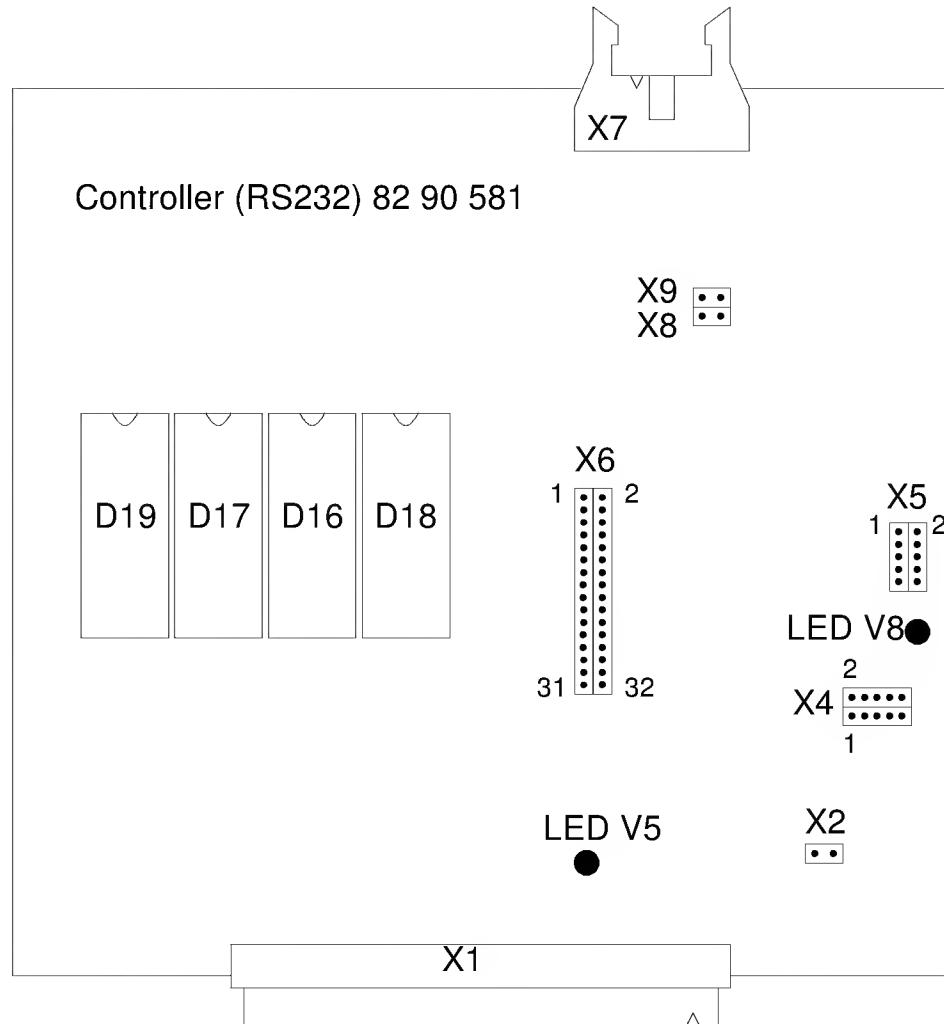
Conditions for the installation into the incubator:

- Cutout for interface (socket) on the back of the unit next to the mains connection available.
- PCB Motherboard 82 90 471 has a modification state  $\geq 03$ .

From serial NO. ARFA (Jan. 1993) the Incubators 8000 SC/IC/NC are designed for installation of this interface.

### 8.2.11.2 Layout plan, configuration and test points

Layout plan:



Component configuration:

Position	Component
D16	EPROM A (odd) 82 90 595 from Software 1.00 Babylink 82 90 599
D17	EPROM B (even) 82 90 594 from Software 1.00 Babylink 82 90 599

**Equipment of jumper fields with jumper 18 14 608:**

Not intended for operation

Test points:

Test point	Function
LED V5 (red)	lights up during normal operation
LED V8 (yellow)	Flashes with 1Hz at short-circuit between Pin 2 and Pin 3 at the connection socket on the back of the device (or Pin 3 and Pin 5 of X7) and flashes during normal operation of the interface
X7 interface socket	Loop-test between Pin 3 and 5

### 8.2.11.3 Function Test

The function test is performed in operable condition of the PCB Controller with the flap under the electronics module hinged down.

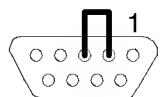
- Incubator switch-on:

Test: LED V5 (red) and LED V8 (yellow) on PCB Controller light up continuously during the incubator self-test (only bars on the actual value displays).

- Incubator self-test completed:

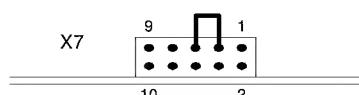
Test: LED V5 (red) lights up, LED V8 (yellow) off.

- Afterwards produce a short-circuit at the connection socket for the interface on the device back panel between pin 2 and 3 (loop-test):



Test: LED V5 (red) lights up, LED V8 (yellow) flashes at 1Hz.

### Possible errors:

Error	Possible causes	Remedy
LED V5 (red) off	Processor error on PCB Controller	Replace PCB Controller
LED V8 (yellow) off during loop test, LED V5 (red) lights up	<ul style="list-style-type: none"> <li>- transmission error on PCB Controller</li> <li>- cable harness from PCB Controller to interface socket defective</li> </ul>	<ul style="list-style-type: none"> <li>- Replace PCB Controller</li> <li>- Perform loop test with short-circuit at plug-in connector X7 of PCB Controller between pin 3 and pin 5:</li> </ul>  <p>If LED V8 (yellow) flashes at 1 Hz there is an error at the cable harness to the interface socket, otherwise on the PCB Controller</p>

#### 8.2.11.4 Exchange in case of repair

The following spare parts can be used for exchange of the complete PCB respective the cable harness with socket:

- PCB Controller 82 90 581
- Software 1.00 BabyLink see 8.2.11.5
- Cable harness RS232 Incubator (with sockets) 82 90 568

#### 8.2.11.5 Repair Information Software

For the time being the following software-version is actual:

- Software 1.00 Babylink 82 90 599

### 8.2.11.6 Retrofitting

The interface can be installed in all Incubators SC/IC/NC from serial No. ARFA (Jan. 1993).

Installation conditions:

- Cutout for interface (socket) available on the device back panel next to the mains input.
- PCB Motherboard 82 90 471 has a modification state  $\geq 03$ .

The following is required for installation:

- Retrofit kit BabyLink Incubator 82 90 607

### 8.2.11.6 Repair information and modification states

up to now no entries

## 8.3      **Climatic sensor**

### 8.3.0      **Table of Contents**

- 8.3.1      Information on Climatic Sensors used
- 8.3.2      Climatic Sensor 82 90 380 and 2M 21 688
- 8.3.3      Testing and Adjustment
- 8.3.4      Replacement and Repair
- 8.3.5      Repair and Change Status

### 8.3.1      **Information on Climatic Sensors**

The following is a list of current climatic sensors where the humidity measurement can be calibrated and the humidity sensor replaced:

<b>Software version</b>	<b>For units</b>	<b>Climatic sensor</b>
20.nn (old)	w/o skin-temperature meas.	82 90 380 with skin temperature connection
20.nn (old)	with skin-temperature meas.	82 90 380 with skin temperature connection
21.nn (new)	w/o skin-temperature meas.	Currently 2 possibilities 2M 21 688 new, without skin temperature connection  In emergencies the old climatic sensor 82 90 380 can also be used for units without skin-temperature measurement.
21.nn (new)	with skin-temperature meas.	2M 21 688 new, without skin temperature connection

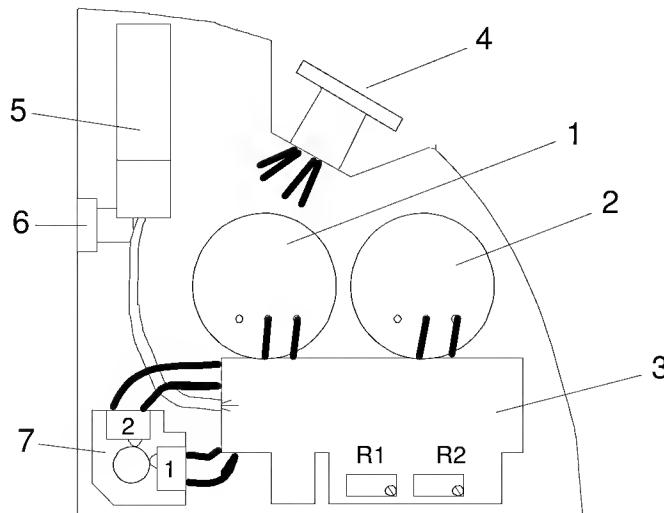
## Features:

82 90 380 = Climatic sensor for 2 O<sub>2</sub> sensors and connection for skin-temperature sensor. This sensor is required for units with SW 20.nn with skin temperature.

2M 21 688 = Climatic sensor has no connection for skin-temperature sensor; otherwise identical to 82 90 380. This sensor cannot be used for units with SW 20.nn with skin temperature.

### 8.3.2 Climatic Sensor 82 90 380 and 2M 21 688

Layout (fig. shows 82 90 380):



Position	Component or Function
1	O <sub>2</sub> -Sensor B mount over PCB 68 50 638
2	O <sub>2</sub> -Sensor A mount over PCB 68 60 638
3	Electronics of humidity measurement
4	Temperature sensors 82 00 486
5	Humidity sensor 82 90 393 with protective cap 82 90 392
6	Socket 82 00 608 for skin temperature sensor (only for 82 90 380)
7	Microswitch 82 00 497 for position identification

In case of repair, all components of the climatic sensor 82 90 380 / 2M 21 688, except the electronics of the humidity measurement, can be replaced. The humidity measurement can be

adjusted with potentiometer R2 (zero-point). The humidity sensor 82 90 393 may be cleaned in distilled water.

Note: The climatic sensors 82 00 910 to 82 00 913 are identical, except for position 3 "Electronics of the Humidity Measurement" and position 5 "Humidity Sensor". In the event of a defective humidity measurement these climatic sensors 82 90 380 have to be replaced.

### **8.3.3 Testing and Adjustment**

#### **8.3.3.1 Temperature Measurement**

The NTCs of the temperature measurement are normally not subject to drift. Both temperature values can be scanned in the service mode (refer to 6.3) whereby the tolerances of the PCB Analog are included. The temperature values in the service mode in the working range of the Incubator must not differ by more than 0.3 °C. In the event of deviations, first check the measurement of the PCB Analog (refer to 8.2.6).

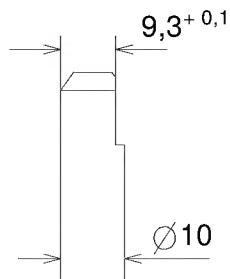
The resistance values of the NTCs can be checked at the connection socket of the climatic sensor between Pin 1 and 2 (Air Temp. Sensor) and between Pin 3 and 18 (Excess Temp. Sensor).

<b>Temperature in °C</b>	<b>Resistance in Ohm</b>
20	6246.0
21	5970.8
22	5709.4
23	5460.9
24	5224.7
25	5000.0
26	4786.1
27	4582.5
28	4388.8
29	4204.4
30	4028.7
31	3861.2
32	3701.6
33	3549.6
34	3404.6
35	3266.3
36	3134.4
37	3008.6
38	2888.5
39	2773.9

### 8.3.3.2 Microswitch

Both microswitches can be checked in the service mode (refer to 6.3).

In the event of problems with inexplicable sensor alarms without storage of faults it is necessary to check the mount pin of the hinge 82 00 489. The dimension  $9.3 + 0.1$  mm must be observed.



### 8.3.3.3 O2 Sensors

Both O2 sensors can be checked in the service mode (refer to 6.3). In addition, after adjustment in the service mode, the target value must be set to maximum to allow identification of non-linearity in measurement with high O2 values. In the event of measurement deviations between both sensors, a sensor alarm is generated and stored in the fault list.

### 8.3.3.4 Humidity Measurement

#### Test equipment required:

- Temperature measuring device compl. 79 01 148
- Humidity and temperature sensor 79 01 476
- Adjustment set humidity sensor 79 01 477

The accuracy of the humidity and temperature sensor must be ensured by regular checks (every 6 months).

#### Testing and Adjustment:

- The Incubator is ready for use and switched off

- Unscrew cover from climatic sensor
- Connect ready-for-use climatic sensor without cover to Incubator
- Using adhesive tape seal air gap resulting from removal of the cover
- Mount humidity sensor at a maximum distance of 60 mm from the humidity sensor. To do so, position the cable of the humidity sensor over the holder of the side double wall and attach the humidity sensor to the black disc of the climatic sensor(e.g. using wire or adhesive tape).
- Switch Incubator on
- Adjust the following values on the Incubator:
  - o Air temperature = 36.0 °C
  - o Humidity = 70 %
- Allow target values to stabilize for 30 min before testing and adjusting. If the measured value on the reference measuring device differs by more than 10% r.h. from the reading on the Incubator the target value on the Incubator has to be adjusted accordingly until a humidity of 60 to 80% is indicated on the reference measuring device.
- Using potentiometer R2 adjust reading on Incubator to value indicated on the reference measuring device
- Secure potentiometer R2 using locking compound
- Assemble climatic sensor ready for use

### 8.3.4 Replacement and Repair

#### Climatic sensor 82 90 380 / 2M 21 688:

With these climatic sensors, all parts can be replaced with the exception of the humidity measurement electronics (see spare parts list). The climatic sensor assembly is to be renewed if the electronics are defective. After replacing the humidity sensor, the humidity measurement is to be checked and calibrated if necessary.

Software version	For units	Climatic sensor
20.nn (old)	w/o skin-temperature meas.	<ul style="list-style-type: none"><li>- 82 90 380 (as before, for 2 O<sub>2</sub> sensors)</li><li>- 2M 21 688 (new), this sensor has no skin-temperature connection</li></ul>
20.nn (old)	with skin-temperature meas.	82 90 380 (as before, for 2 O <sub>2</sub> sensors). The skin-temperature sensor connection is required for this climatic sensor.
21.nn (new)	w/o skin-temperature meas.	<p>Currently 2 possibilities</p> <ul style="list-style-type: none"><li>- 2M 21 688 (new), this sensor has no skin-temperature connection</li><li>- In emergencies the old climatic sensor 82 90 380 can also be used for units without skin-temperature measurement.</li></ul>
21.nn (new)	with skin-temperature meas.	- 2M 21 688 (new) without skin temperature connection

#### Features:

82 90 380 = Climatic sensor for 2 O<sub>2</sub> sensors and connection for skin-temperature sensor. This sensor is required for units with SW 20.nn with skin temperature.

2M 21 688 = Climatic has no connection for skin-temperature sensor; otherwise identical to 82 90 380. This sensor cannot be used for units with SW 20.nn with skin temperature.

## 8.3.5 Repair Information and Change Status

### 8.3.5.1 Incubator 8000 IC with SW 21.nn, new climatic sensor, new connection location for skin-temperature measurement 06.95

The new climatic sensor 2M 21 688 features the following modifications as opposed to 82 90 380:

- The skin-temperature sensors (1 or 2) are connected as of SW 21.nn to the left side of the basic housing. Use can only be made of the familiar disposable sensors 2M 20 737 as the connector is different. The adapter 2M 20 736 which used to be required for these disposable sensors is no longer needed.
- Pay attention to Section 8.3.5 when renewing complete climatic sensor.
- Important: Use is not to be made of the climatic sensor 82 90 380 on units with SW 21.nn with skin-temperature measurement. In this case there is a danger of two skin-temperature sensors being connected in parallel.